Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

MAY ★ 1952

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 111—Journal Section of The American Society of Heating and Ventilating Engineers

Four miles of tubing connects tanks and gages .... (see page 72)

How To Design Piping 99

Using Well Water for Air Conditioning . . 75

Protecting Heating System Against Corrosion 92

Complete Contents of This Issue 3

EXHAUST VENTILATION FOR MACHINING METALS OF HIGH TOXICITY . . 86

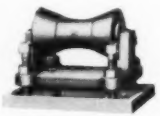
ADJUSTABLE PIPE HANGERS AND SUPPORTS

for every piping requirement

NO. 3 OF A SERIES SHOWING THE GRINNELL LINE

pipe rolls

Pipe Roll and Plate
Fig. 277
2 to 30 in. pipe



Adj. Pipe Roll with Base
Fig. 274
Without base: Fig. 275
2 to 30 in. pipe

Adj. Swivel Pipe Roll
Fig. 174
2½ to 12 in. pipe

Adj. Pipe Roll
Fig. 276
4 to 30 in. pipe

Pipe Roll Complete
Fig. 271
2 to 30 in. pipe

Single Pipe Roll
Fig. 171
1 to 30 in. pipe

pipe saddles

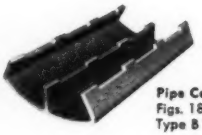
Pipe Stanchion Saddle
Fig. 259
4 to 36 in. pipe

Adj. Pipe Saddle Support
Fig. 264
2½ to 36 in. pipe

Pipe Saddle Support
Fig. 258
4 to 36 in. pipe

Anchor Chair
Fig. 197
4 to 24 in. pipe

Pipe Covering Protection Saddle
Figs. 185, 186, 187, 188
Type A for 10 in. and smaller



Pipe Covering Protection Saddle
Figs. 185, 186, 187, 188
Type B for 12 in. and larger

Write for Hanger Catalog

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WHENEVER PIPING IS INVOLVED

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Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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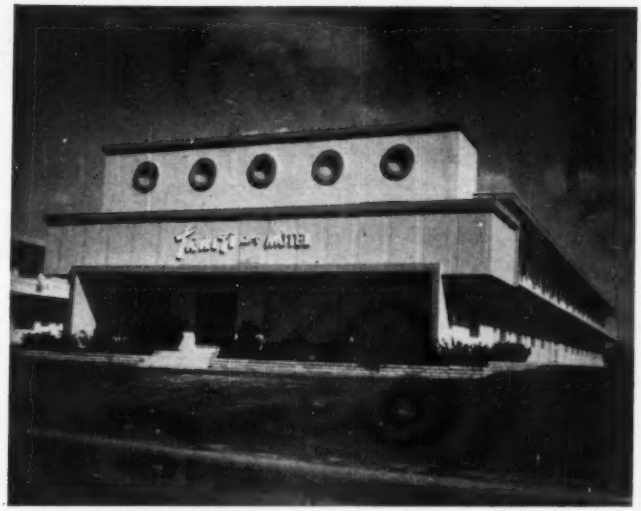
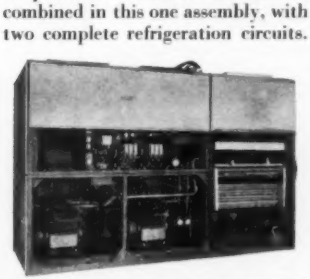


Dual-Circuit Air Conditioning Economy Proved at Tahiti Apartment Motel

Miami Beach installation cools 62 rooms, lobby and coffee shop with single package unit

ONE USAIRCO 50 H.P. DRK comfortably cools the 62 rooms of the Tahiti, plus this modern motel's lobby and coffee shop. The Dual-Circuit Refrigerated Kooler-aire completely processes and conditions air within a single "packaged" unit. Air conditioner, compressor and evaporative condenser sections are combined in this one assembly, with two complete refrigeration circuits.



Architect Norman M. Giller, had more than cool comfort in mind when he chose USAIRCO's DRK for the Tahiti. Since definite limitations on starting current are in effect in this Miami Beach area, he looked for an air conditioning plant that could meet the problem. The answer was this USAIRCO unit because DRK's starting current requirements are only ½ of normal, due to the time delay relay. There is no need for reduced voltage starters.

Seasonal variation requires definite capacity controls. Again, the USAIRCO DRK proved the answer. It is wired with a two-stage thermostat, which automatically puts into operation one or both compressors, depending on load requirements. When operating at reduced capacity, separate refrigeration circuits provide effective dehumidification.

All rooms in the Tahiti face outside and have manually adjustable register controls. Supply and return duct system is connected to the DRK located in the center of the building.

Each DRK unit is custom fabricated at the factory. Available in 7 sizes, from 10 to 50 H. P.

See your nearest USAIRCO agent or write to Dept. HP 552

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Minneapolis 14, Minn.

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General Contractor: San Ford Kay Construction Co.
Air Conditioning Contr.: Airko Air Conditioning

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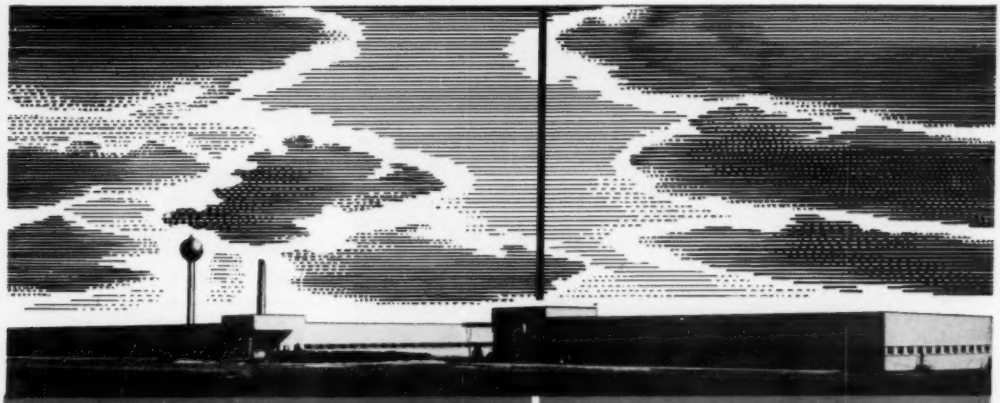

design for water

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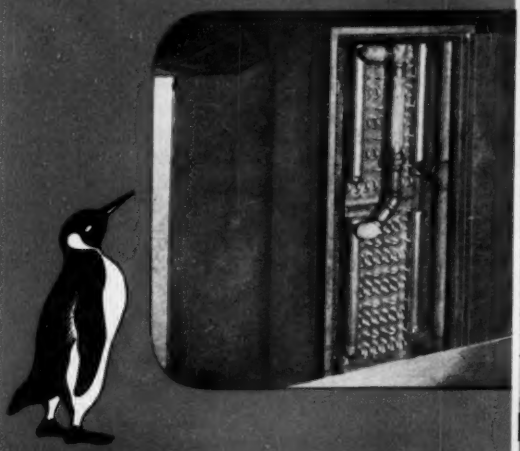

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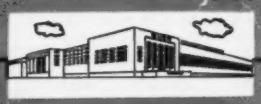

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Heating Piping & Air Conditioning

Vol. 24, No. 5

(with which is merged the Aerologist)

MAY 1952

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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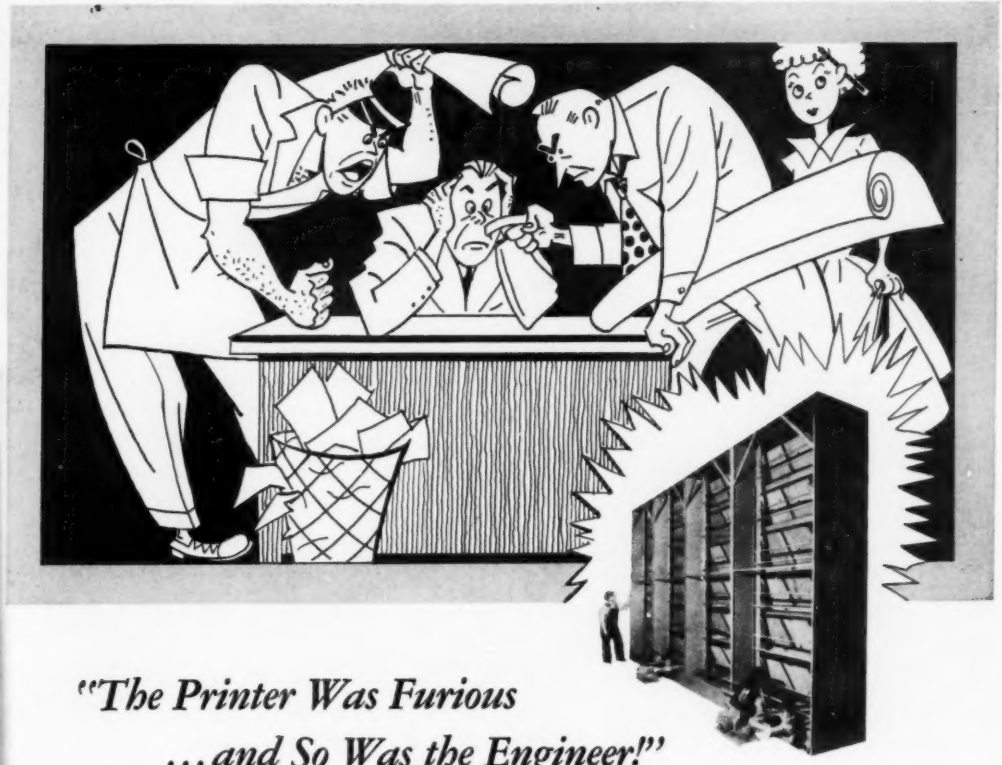

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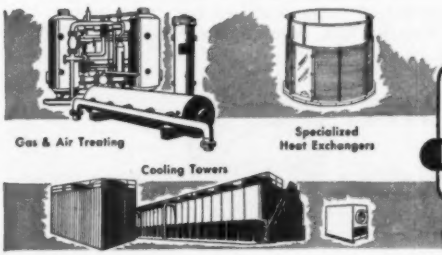

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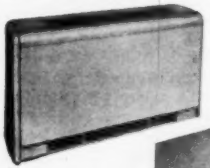

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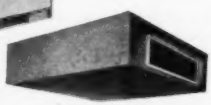

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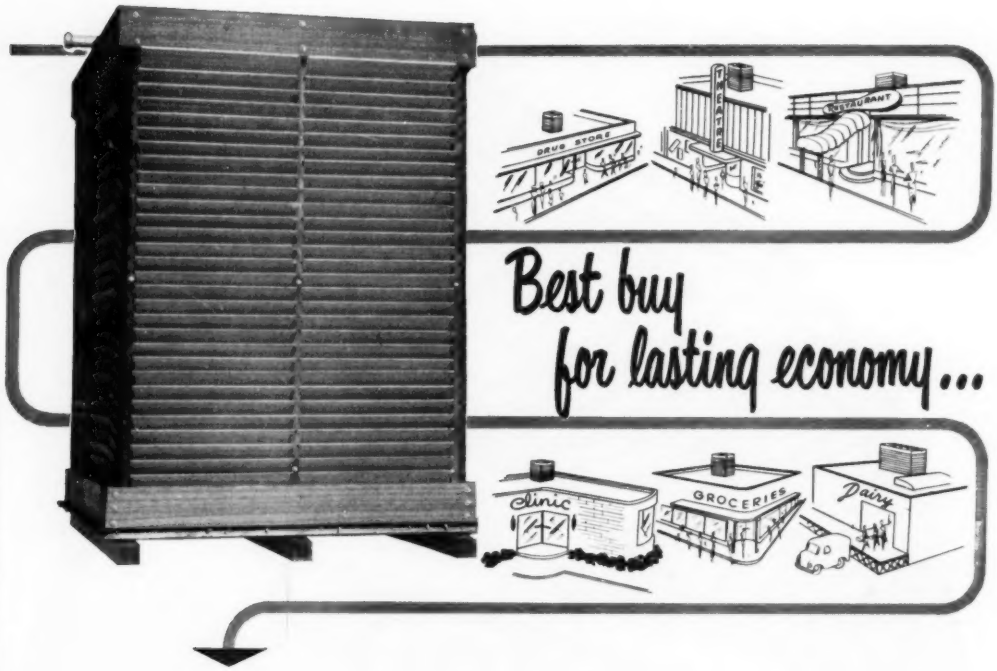

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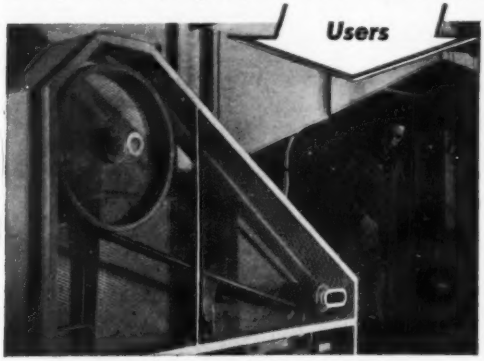

Save Adjusting Time. Seasonal changes may require adjustments in air flow. These can be made quickly with *Vari-Pitch* sheaves without dismantling drive and switching sheaves.

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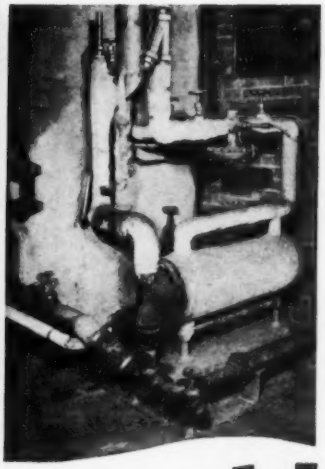

Sarco type 24-30 Temperature Regulator is pilot-operated and single seated for tight shut off when no water is drawn. The thermostat in the water discharge from the heater responds instantly to load changes and holds the water temperature constant — Never too hot or too cold.

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Self-Operated Temperature Regulators

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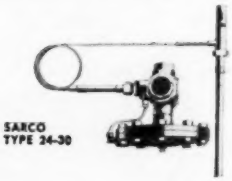
Sarco can solve your control problem within your budget



SARCO TYPE 24-30

Catalog No. 605 lists 12 different styles for heating, cooling and air conditioning; temperatures 0-300°F; valve sizes ⅜" to 8". Write for your free copy today.

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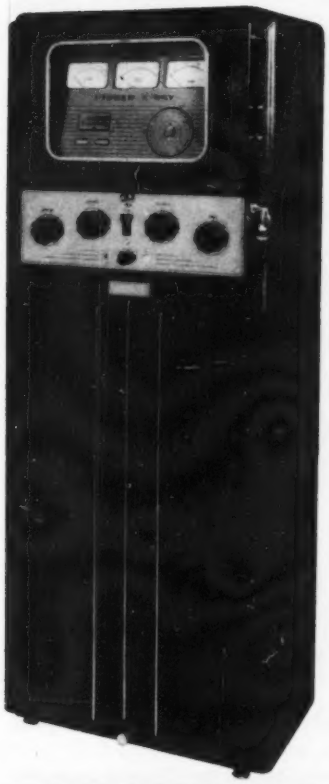
SARCO COMPANY, INC., EMPIRE STATE BUILDING, NEW YORK 1, N. Y.

Factory at Bethlehem, Pa. • Represented in Principal Cities • Sarco Canada, Ltd., 496 Church Street, Toronto 5, Ontario

Picker X-Ray Corporation

"For accurate duplication of X-ray densities their resistors must be stable"



says O. N. Jones, The Ambos-Jones Company, Cleveland, Ohio, representative for Ward Leonard Electric Company

Duplicating densities of precise radiographs over prolonged periods demands exacting control of milliamperage through the X-ray tube. This means filament temperature must be accurately set.

That is why the absolute balance of thermal characteristics of Ward Leonard resistors is of utmost importance to the Picker X-Ray Corporation.

The only way to be sure that all resistor components will react the same to changes in temperature is to balance their thermal characteristics. In this way, there is no loosening, no failure, due to unbalance. Heat affects all parts the same way, which, in turn, means longer life, *stable performance.*

This stability in the presence of thermal shock is one of the major reasons the Picker X-Ray Corporation uses Ward Leonard STRIPOHM resistors in their V-12, 200 milliampere, 100 PKV X-ray controls.

The performance of VITROHM wirewound resistors, rheostats, and other electric controls under the severest operating conditions is proof of their complete dependability.

For correct, accurate current control, specify Ward Leonard VITROHM Resistors.

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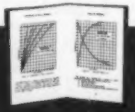


Ward Leonard's complete engineering textbook, "Handbook of Power Resistors," $3. per copy.

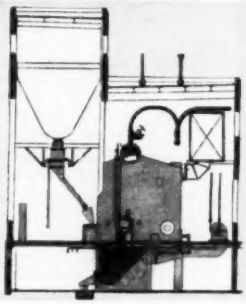
"74.2% MORE STEAM PER DOLLAR-

that's what this modern coal installation gives us at Perfection Stove Co.!"

says George I. Chittenden, consulting engineer for the Perfection Stove Company.

Perfection's old installation, if operating today, would generate 1,362 lbs. of steam per hour per dollar. The new plant produces 2,373 lbs. of steam per hour per dollar. Here's proof of the economy and efficiency of bituminous coal burned with modern equipment.

This view of Perfection Stove's new steam plant shows the coal elevator and ash silo. Coal is delivered through an under-track hopper, lifted by elevator to storage. A pneumatic system carries ashes to the silo.



This sectional drawing of the plant's boiler installation shows the coal bunker over the firing aisle. A weigh larry with dust-proof connection feeds coal to the stokers. The plant is clean and efficient—typical of the modern design that makes full use of coal's inherent advantages.

If you operate your own steam plant, you can't afford to ignore these few down-to-earth facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

● More and more consulting engineers are advising their clients that *bituminous* coal is the best buy for steam fuel. *Here's why:* Nearly everywhere coal yields more BTU's per dollar . . . modern combustion installations step up this inherent economy . . . up-to-date coal- and ash-handling systems cut labor costs to a minimum.

Tremendous reserves give coal a future dependability of supply no other fuel can offer. And to mine this coal, America has the world's most productive and efficient coal industry—making coal the one fuel most likely to remain reasonably stable in price.

If you're building or planning to modernize a steam plant, call in a competent consulting engineer. He'll show you how a modern coal installation can save you money and do a more efficient job, too!

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
WASHINGTON, D. C.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!

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...have set their own standards

Many of the largest users of Welding fittings refuse to accept any other fittings than WeldELLS.

They have found that when the name, WeldELL, is stamped into a fitting, that fitting can be accepted without question for any service for which it is designed.

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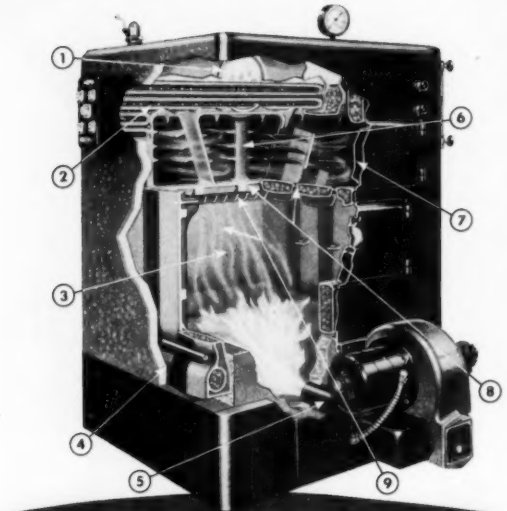
Engineered to solve the heating problems of larger homes



Features That Assure Dependable Fuel-Saving Operation

Exbrook Boiler

FOR OIL OR STOKER FIRING

● Designed exclusively for automatic firing with coal or oil, the Exbrook is ideally suited for larger homes, or small to medium sized apartment and other buildings. Made of durable cast iron to give long-lasting service, this efficient boiler is noted for its dependable operation. A careful check of the features listed below will show you why the Exbrook may be just the answer to your heating problems. The Exbrook and other larger-than-average-capacity boilers in the American-Standard line are sold through selected wholesale distributors to heating contractors.

1. EXTRA LARGE NIPPLES—extend below water line and assure free and rapid circulation of boiler water and quick heat response. Also permit use of a built-in or external water heater.

2. BUILT-IN WATER HEATER—Tank or tankless type is available on oil boilers at small extra cost for providing year 'round hot water.

3. COMBUSTION SPACE—adequate in size, correctly proportioned and air-tight for burning fuel efficiently and economically.

4. INSULATION—suitable insulating material underneath attractive metal jacket helps prevent heat loss and keeps jacket cool.

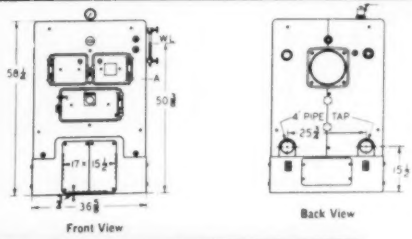
5. OIL BURNER—a perfectly matched, flange mounted Arcoflame Oil Burner with its famous fuel-saving "sun-flower" flame, is shown. Base plate also permits easy installation of stoker.

6. MULTI-FINNED FLUES—provide long flue travel with maximum surface for extracting available heat from hot gases, for peak efficiency and economy.

7. STURDY, HEAT-PROTECTED DOORS—clean-out and fire doors of heavy construction have cast iron baffle linings to protect them against warping.

8. TIGHT JOINTS—where sections and doors contact other surfaces they are machine ground to form tight joints and close fit. This prevents short circuiting of gases, uncontrolled infiltration of air and escape of odors.

9. DIRECT HEATING SURFACE—ample finned heat-absorbing surface exposed directly to fire, for extra efficiency.



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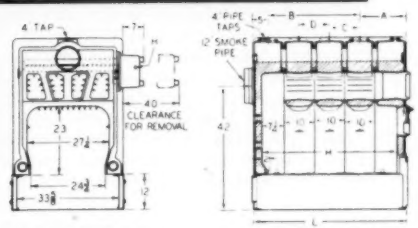

Center Section—showing tankless water heater

Cutaway through boiler sections

American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

Serving home and industry

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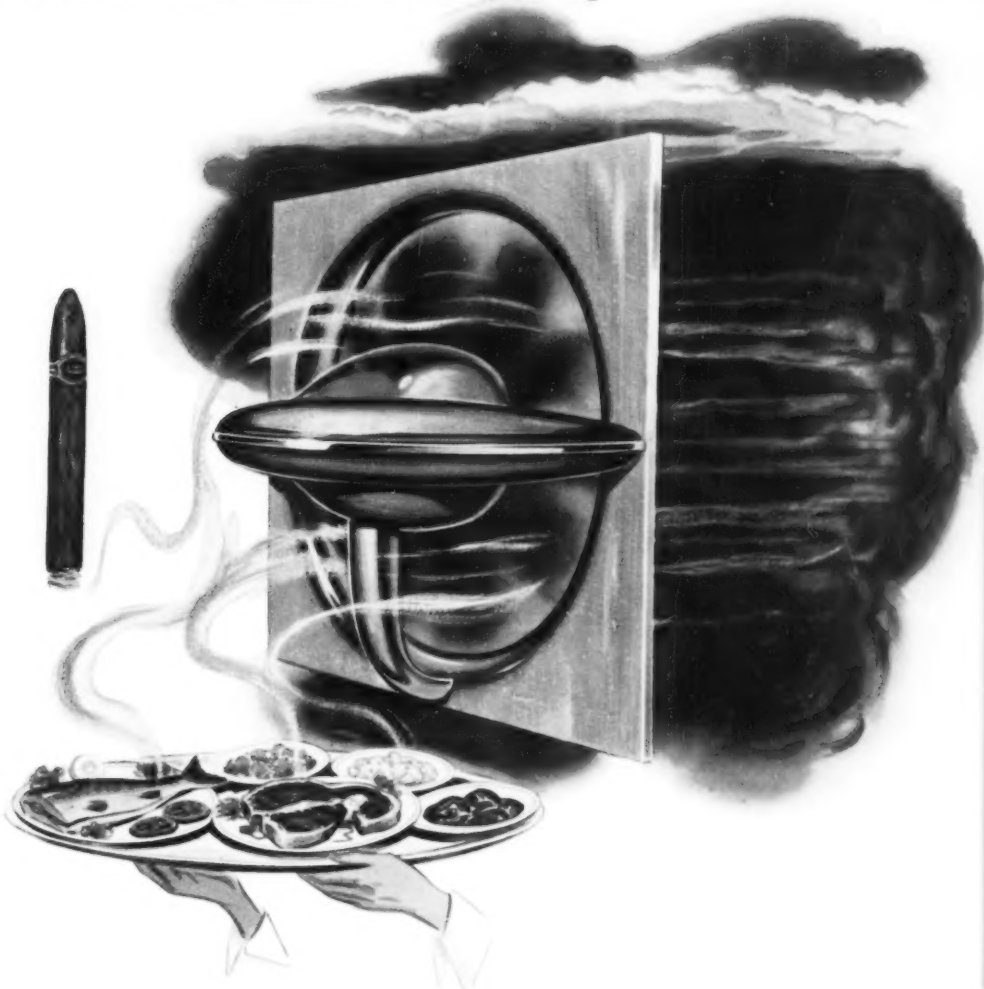
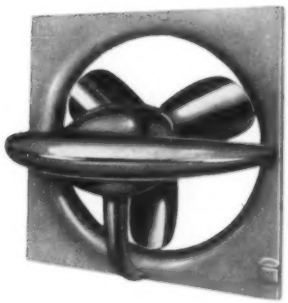
American Blower – a time-honored name in air handling





American Blower Model A Ventura Ventilating Fan. Capacities from 1000 cfm to 9700 cfm, free delivery.

Nothing, absolutely nothing, overcomes the objections to bad odors quite as well as removing them.

And American Blower Ventura Fans (see above) do this job quickly, quietly and at low cost.

Ventura Fans, Utility Sets, Heating, Cooling Coils, and complete Air Conditioning Units are but a part of American Blower's line of quality products.

You can profit from these products. Phone our nearest branch office for data.

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Serving home and industry

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"I wonder what happened to me !" said Alice

ALICE in Wonderland ate the magic cake and grew until she was more than nine feet tall. Our National bureaucracy also seems to have partaken of the magic cake of power. Bureaus in our government have grown in number and scope until their activities now control, to a great extent, the lives of all individual Americans. Department after department adds more and more people -- state, justice, commerce, treasury -- not to mention those sprawling emergency born agencies of price control, N.P.A. and other alphabetical subdivisions.

The number of employees of our federal, state and local governments continues to grow. During many recent months, personnel was added to the federal payroll at the rate of 1,500 daily.

What is the reason for this mushrooming? The Korean War? Threat of war in Europe, Southeast Asia, or the Middle East? Obviously not! A glance at the federal budget gives the answer. The estimated cost of all governmental functions for the fiscal year 1952 is in excess of 70 billions of dollars, an increase of 26 billions, or approximately 60% more than last year.

When will it end? Only you, the individual citizen, who carries the bureaucratic load on his back, can stop it. It will end when enough patriotic men and women demand from congress that the Washington Wonderland start shrinking back to reasonable proportions.

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An Authoritative Guide to Good Trapping Practice

THE *new* Armstrong Steam Trap Book (Catalog J) is a practical working manual for any man concerned with the efficient operation of steam equipment through the correct selection, installation or maintenance of steam traps.

New Trap Catalog Section — complete data on Armstrong cast semi-steel and forged steel inverted bucket traps, compound traps and ball float traps, including: list prices, dimensions, capacities, service pressure ratings and materials.

New Handbook Section — tells how to select the right size trap for nearly every type and size of equipment; including steam mains, purifiers, separators, unit heaters, jacketed kettles, retorts, hot water heaters, coils and syphon drained cylinders; explains how to use the new Armstrong trap capacity chart; explains and gives recommended safety factors; includes reference tables and charts on such subjects as warming-up and radiation loads, condensing rates, recommended trap sizes, Armstrong trap EDR ratings, effect of scale on submerged coil condensing rates.

New Installation and Maintenance Section — covers trap hookups, use of check valves, preventive maintenance schedules, troubleshooting, many practical suggestions and answers to common problems.

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traps help uncover hidden steam treasure

The facts are these:

A large southern chemical company about a year ago was up to capacity on their boilers. New process units were being added, requiring more steam—a new boiler seemed inevitable.

About that time they began replacing their old-type traps and bleed-off valves with Yarway Impulse Steam Traps and Strainers. Today, even with the new process units added, their daily steam consumption is nearly 100,000 lbs less than a year ago—the superintendent gives Yarway Impulse Traps credit for the saving.

Yarway Impulse Traps are *designed* to insure sending the most premium B.T.U.'s at top temperature into your product or process . . . *to get equipment hotter sooner and keep it hot!*

Yarway's have 11 other advantages, too—such as *small size, low maintenance, low cost, and availability* from over 200 Industrial Distributors. Write for Bulletin T-1740. Or for steam trap advice, call on your nearby Yarway service engineer.

YARNALL-WARING COMPANY
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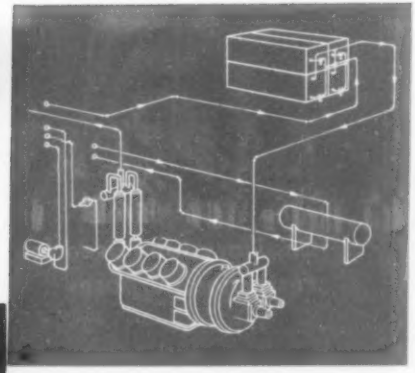
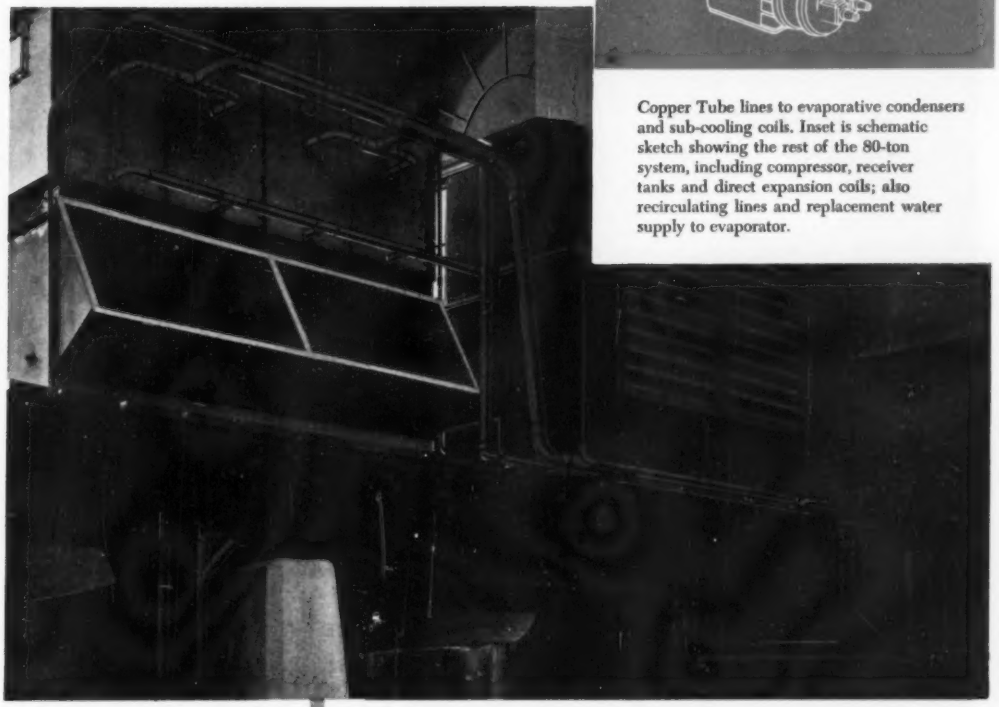
the steam trap designed with more production in mind

ANACONDA All-Copper refrigeration piping cuts installation costs



Copper Tube lines to evaporative condensers and sub-cooling coils. Inset is schematic sketch showing the rest of the 80-ton system, including compressor, receiver tanks and direct expansion coils; also recirculating lines and replacement water supply to evaporator.



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Pictured here is part of an air conditioning system recently installed in a large office building. Noteworthy is the fact that ANACONDA Copper Refrigeration Tubing, ANACONDA Wrought Copper Fittings and American Vibration Eliminators were used throughout. This lightweight tubing with solder-type fittings was selected because of its easy installation and lower labor costs. Also important was the fact that copper tubing is non-rusting and corrosion-resistant and therefore ideally suited for water and refrigerant lines.

If you are concerned with the design or installation of an air conditioning or refrigeration system, you'll find it pays off in long-time dependable service to specify ANACONDA Refrigeration Products. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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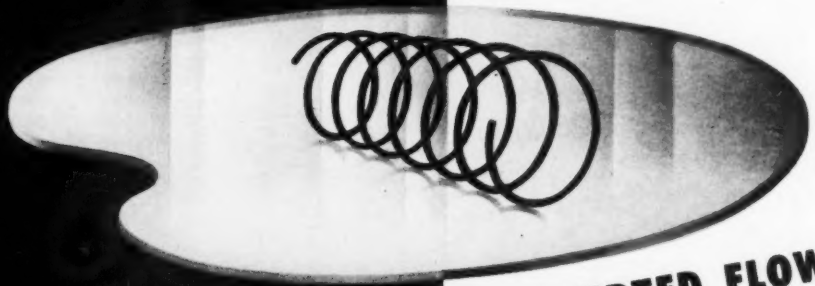
for *consistent* uniformity—ask for ANACONDA® refrigeration products

—the WOLVERINE Capillary tube used for restriction purposes

SECOND OF A SERIES OF ADVERTISEMENTS THAT TELL ABOUT PRODUCTS THAT MEAN MUCH TO

HEATING, PIPING AND AIR CONDITIONING ENGINEERS



NTERRUPTED FLOW

Being plug drawn, tube possesses an inside wall that glass, thus assuring a flow of liquids ough the tube that is uniform and This feature makes the Capilator rsal choice for use where controls ust be absolutely dependable.

The Capilator a product patented by Wolverine and represe one of the many tube develop-ments we ha designed to make your job easier and your pro ucts as efficient as possible.

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Many of the big pharmaceutical houses use Worthington air conditioning and refrigeration machinery to control chemical reactions, inhibit bacteria, prevent deterioration.

And many a corner drug store keeps up "hot weather" business by using Worthington air conditioning to bring in customers.

No other manufacturer makes *so complete* a line. A Worthington system is all Worthington-*made* — not just Worthington-assembled — assuring you of perfectly balanced operation and unit responsibility.

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A.2.8

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You can drain, vent or shut off individual zones in a radiant heating system with EQUATEMP* balancing valves. A butterfly-type disc, fitted with a leak-proof synthetic rubber "O" ring, shuts off tight when the valve is closed.

EQUATEMP* may be regulated by using either Allen-type wrenches or the handy key provided. For convenience, EQUATEMP* can be installed in upright position for installation near the floor, or inverted for overhead or ceiling installation.

FIGURE 1

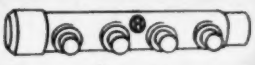
FIGURE 2

VENTING OR DRAINING IN UPRIGHT POSITION. Figure 1. Automatic vent installed in top drain. Figure 2. Bottom drain plug removed for draining of system. Valve may be operated with key from above.

FIGURE 3

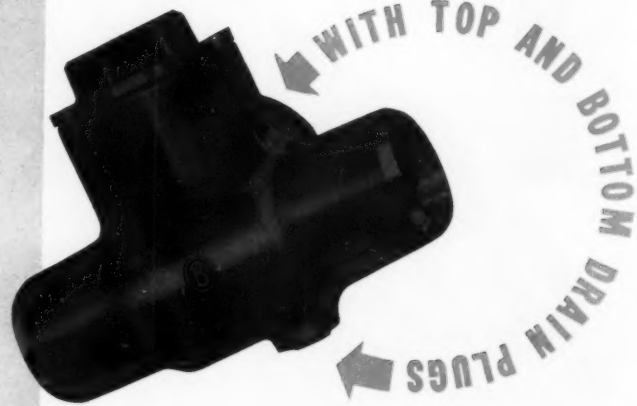
FIGURE 4

VENTED OR DRAINING IN INVERTED POSITION. Figure 3. Automatic vent installed in the bottom drain. Figure 4. Top drain plug removed for draining of system. Valve may be operated with key from below.



EQUATEMP MANIFOLD FITTINGS in combination with Equatemp solder-type valves are the time-saving and economical way to balance hot water radiant systems. Available with either three or four outlets, they can be combined to form manifolds of any desired length.

For additional information, contact your local distributor of Ohio Brass Valves or send in coupon below.



A NEW VALVE FOR HOT WATER RADIANT HEATING

You can install this valve anywhere. Upside down or right side up, EQUATEMP* can be operated in any position. Two removable plugs are built right into the valve as shown above. You can install any one of several standard venting devices in place of the top plug, or you can drain the system simply by removing the bottom drain plug.

Use EQUATEMPS the next time you install a balanced radiant heating system. EQUATEMPS are available for use on $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{3}{4}$-inch tubing and on $\frac{3}{4}$-inch threaded pipe.

* TRADE-MARK

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MANSFIELD, 3, OHIO

Please send me EQUATEMP circular 1214-V

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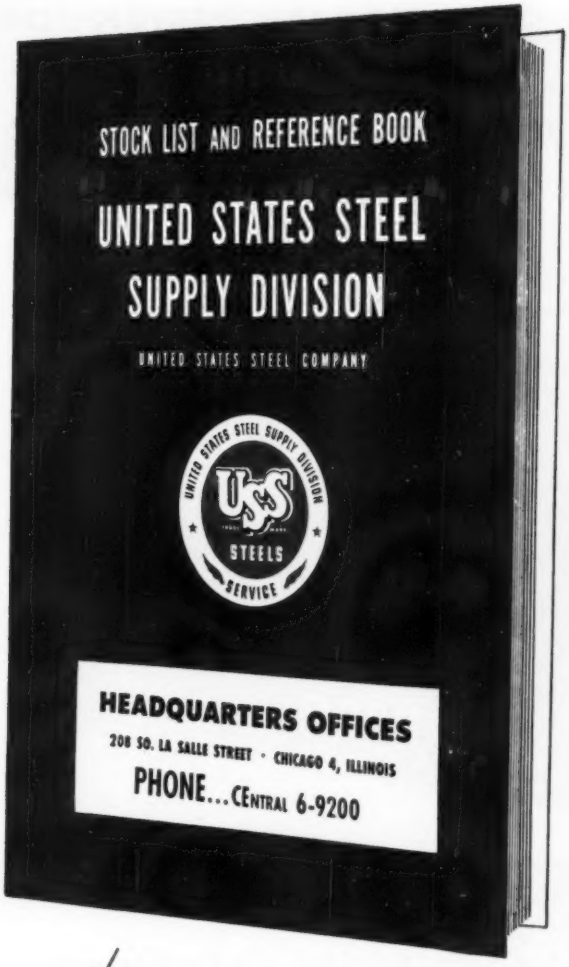

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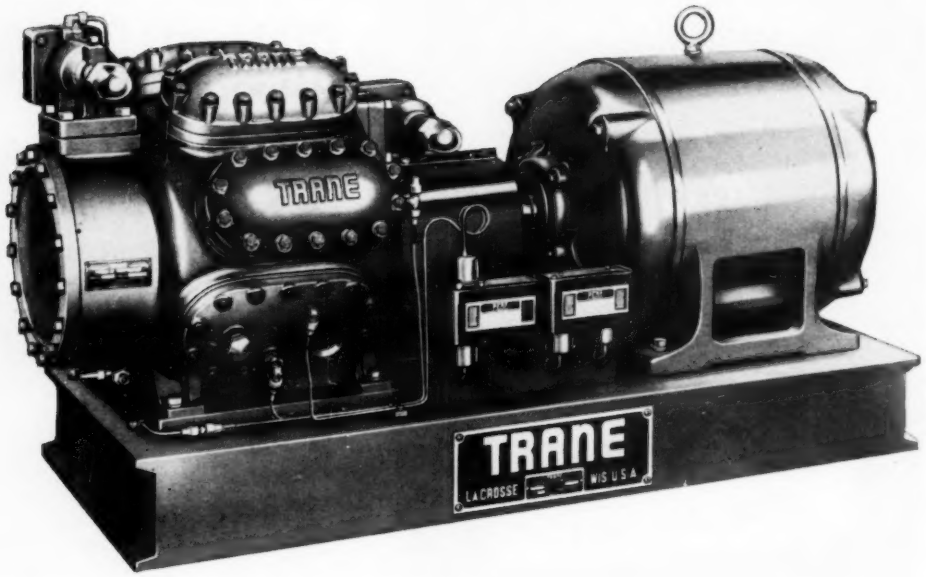
MODERN DESIGN FOR

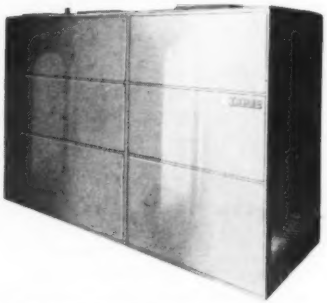
TRANE refrigeration



Now! New 15 and 20-Ton Self-Contained Air Conditioners

A Complete System in an Easy-to-install Package

Everything for complete air conditioning—compressor, condenser, evaporator and fans—in one compact unit. Factory engineered, built and assembled so only simple water piping and electrical connections are required. Available with water cooled or evaporative condensers built right into the unit. For the consulting engineer—an easy-to-specify, easy-to-install unit on the medium sized job. For the heating contractor—an easy way to get into the profitable air conditioning business.



MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING

PLUS PERFORMANCE—

for air conditioning

Now, more than ever before, TRANE provides a single, reliable source for creating the weather conditions demanded by today's building design. TRANE refrigeration and air conditioning products including coils, units of all kinds and fans, are designed together and built together for use together.

In the complete TRANE line there are both centrifugal and reciprocating compressors—offering a wide range of capacities from 3 to 200 tons. What's more, TRANE offers you *both* types of compressor equipment so that you can select precisely the kind of equipment that is right for your job.

Power saving unloader operation! Drastically reduced valve wear!

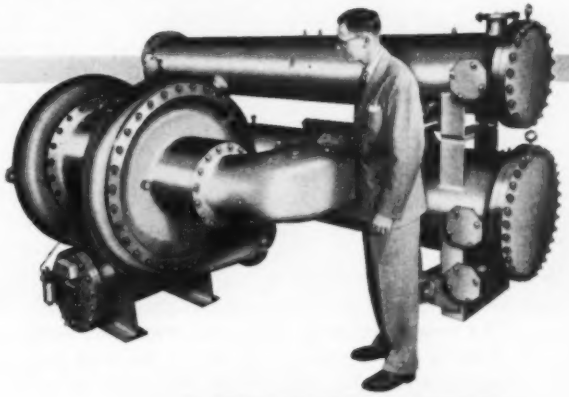
TRANE RECIPROCATING COMPRESSOR

This new masterpiece of modern design provides reduced power requirements as air conditioning loads are reduced—provides smoother, quieter operation over a longer period of time.

Cylinder loading and unloading is completely automatic as loads increase or decrease. Special design keeps refrigerant always free of dirt and oil.

Available with condenser mounted on top. In sizes up to 50 tons.

See TRANE Bulletin DS-361 for further information.



TRANE CenTraVac

First hermetically sealed centrifugal compressor! First in capacities as low as 45 tons! Capacities range from 45 to 200 tons. When air conditioning loads are reduced the TRANE CenTraVac automatically responds with lowered power consumption. This means power economies.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . . Toronto
Offices in 80 U.S. and 14 Canadian Cities

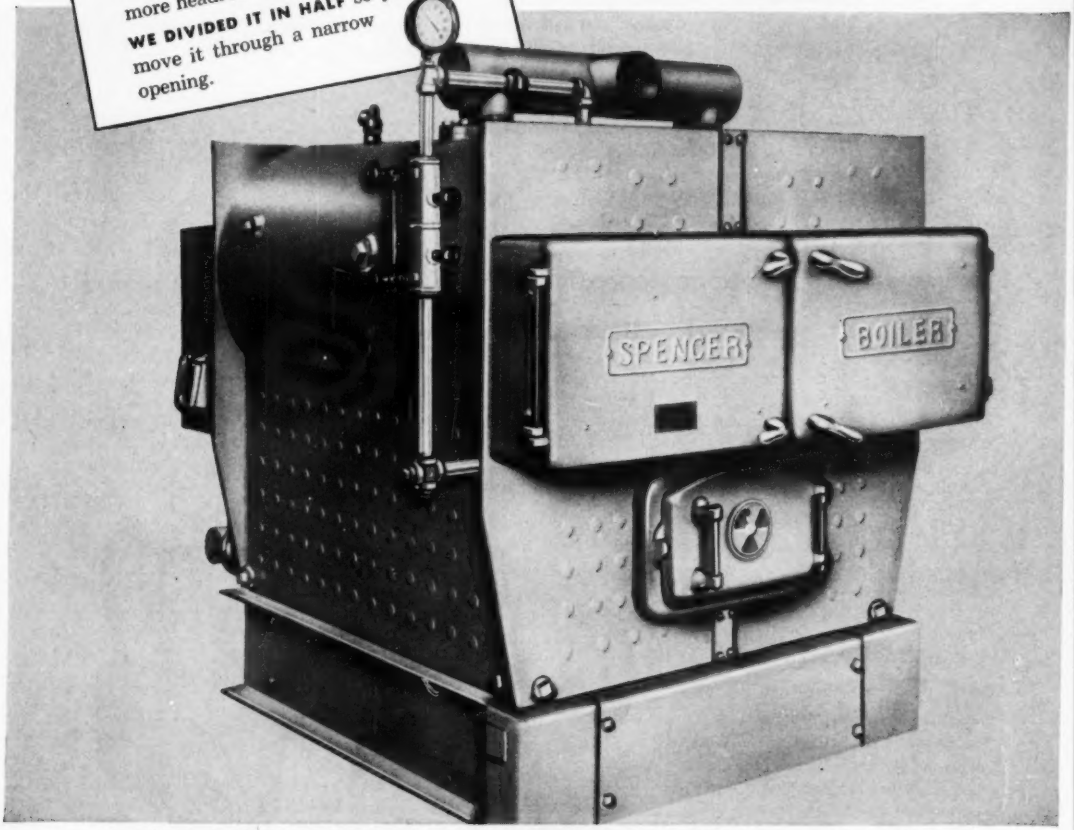
AND VENTILATING EQUIPMENT

LOOK WHAT WE DID!

WE FLATTENED IT OUT to give you more headroom.

WE DIVIDED IT IN HALF so you can move it through a narrow opening.

New!



The new Spencer Divided Low-Waterline Boiler is available in a range of sizes from 3,500 to 42,500 square feet, steam. Working pressures are 15 pounds steam and 30 pounds water. Also available for working water pressures up to 100 pounds.

SPENCER
HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

THERE IS A SPENCER

SPENCER'S

UNIQUE DIVIDED LOW-WATERLINE BOILER

solves problems of low headroom, excavation, and limited entry space

LOW WATERLINE

permits installation where headroom is at a premium. Overall height of Spencer's Low-Waterline Boiler is approximately 25% less than conventional firebox boilers.

DIVIDED DESIGN

permits entry through narrow basement openings. The two watertight sections can be moved in *separately*, yet require no welding for installation and assembly.

Designed, constructed, and stamped in accordance with requirements of the ASME Boiler Construction Code.

Rated in accordance with SBI Code.

Inspected and approved by licensed National Board Insurance Inspector.

With many time-tested Spencer advantages, too, including:

FAST-STEAMING — through the use of staggered rows of fire tubes.

SELF-CLEANING — water sides of heating surfaces kept free of sediment for sustained high-efficiency operation.

INSTANTANEOUS or TANK-TYPE service water-heating coils, in a wide range of capacities.

QUICKLY CONVERTIBLE from mechanical to hand-firing, whenever desired.

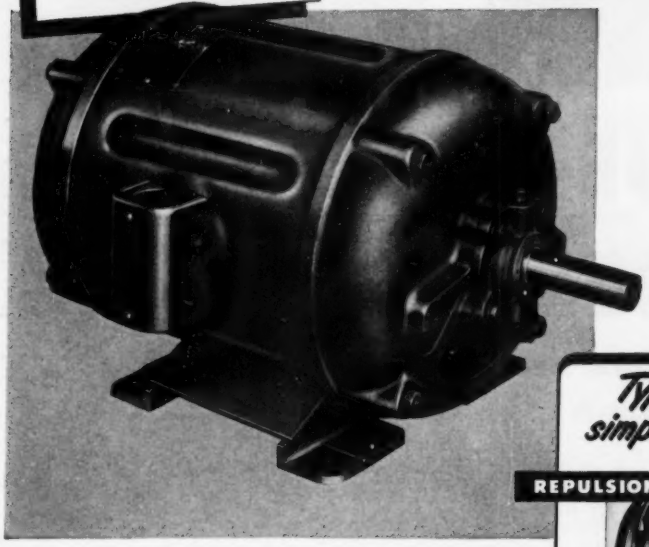
HIGH FIREBOX — all sizes contain extra-high fireboxes for quiet and complete burning of fuels.

FOR EVERY BUILDING . . . FOR EVERY FUEL

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

Wagner
Type RA Motors—

dependable
versatile
troublefree



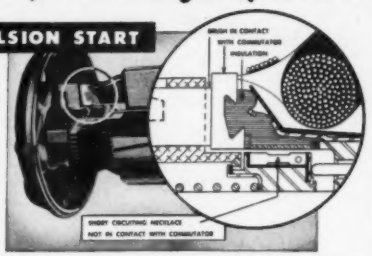
So many manufacturers of motor-driven equipment and appliances in every type of industry have chosen the Wagner Type RA repulsion-start induction motor as standard equipment for their products that it has become known as industry's general purpose motor.

Type RA is first choice for single-phase applications because of its ability to start heavy loads with low starting current. This makes it especially suitable for machines that have high inertia or heavy friction at starting. Then, too, Type RA is chosen because it gives years of reliable service . . . is economical to maintain . . . requires only minimum servicing . . . and is free from vibration and noise.

When you standardize on Wagner Motors—you get the advantages of a liberal warranty . . . of nationwide service facilities, with replacement motors and parts available from 25 Wagner-owned Service Branches and more than 650 Authorized Service Stations. You can choose from a wide variety of types and sizes (from 1/125 to 400 hp). Bulletin MU-185 gives complete information—write for your copy.

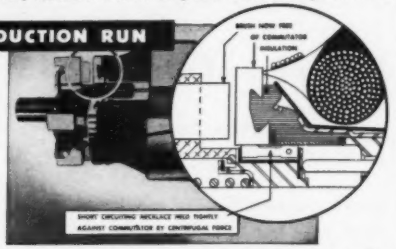
Type RA offers the most simplified design to provide:

REPULSION START



Starting period—Short-circuiting necklace is not in contact with commutator bars. A governor spring holds barrel in starting position. Brush assembly completes selected circuits enabling motor to start as a repulsion motor.

INDUCTION RUN


BRUSH NOW RIDES OF COMMUTATOR
INSULATION
SHORT CIRCUITING NECKLACE HELD TIGHTLY AGAINST COMMUTATOR BY CENTRIFUGAL FORCE

Running period—Governor weights (actuating pushrods) have forced spring barrel forward until short-circuiting necklace connects commutator bars to short-circuiting ring, forming a "squirrel cage" to permit operation as an induction motor.

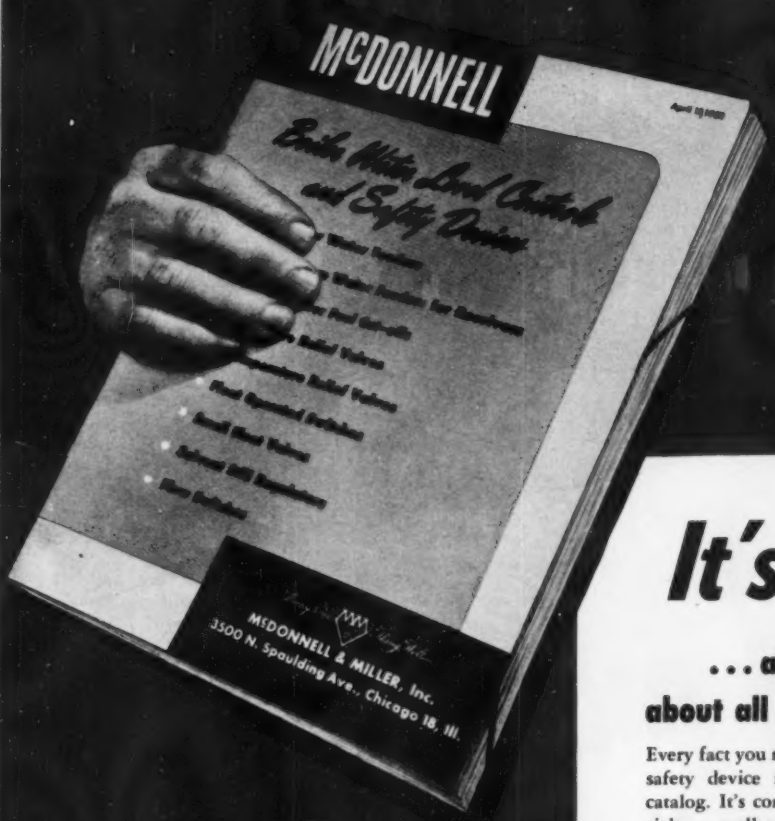
WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation EST. WE 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M49-13



It's Ready

. . . all essential facts about all McDONNELL products

Every fact you need about every McDonnell boiler safety device is covered by this new 24-page catalog. It's complete, but boiled down to essentials . . . well organized for quick, easy reference.

It covers not only the regular run of boiler water level controls and low water cut-offs but also many McDonnell controls for special conditions. Latest facts on McDonnell Btu. rated relief valves are fully presented including new McDonnell temperature relief valves.

The pages of this catalog tell the complete facts on when to use each McDonnell control for every type and size of steam boiler, hot water boiler, storage tank, or water heater. Coupon brings your copy.

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Send me the literature checked —

- ☐ New 24-Page Catalog
- ☐ Condensed Catalog and Price List
- ☐ Service Manual

Name_____

Business_____

Address_____

City and State_____

A JOY Axivane Fan in a commercial store—chosen for its low noise level, compactness, and simple and easy installation.

The JOY AXIVANE® FAN

Mounts Right in the Air Duct—

Saves space, installation costs, gives you quieter, more efficient ventilation!

Write for Bulletins, or

Consult a Joy Engineer

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

MORE POWER
for your dollar!

15
different Circulators

TWO TYPES • HORIZONTAL OR VERTICAL

EACH **DESIGNED** FOR ITS RATED CAPACITY

LARGER MOTORS • HEAVIER CONSTRUCTION

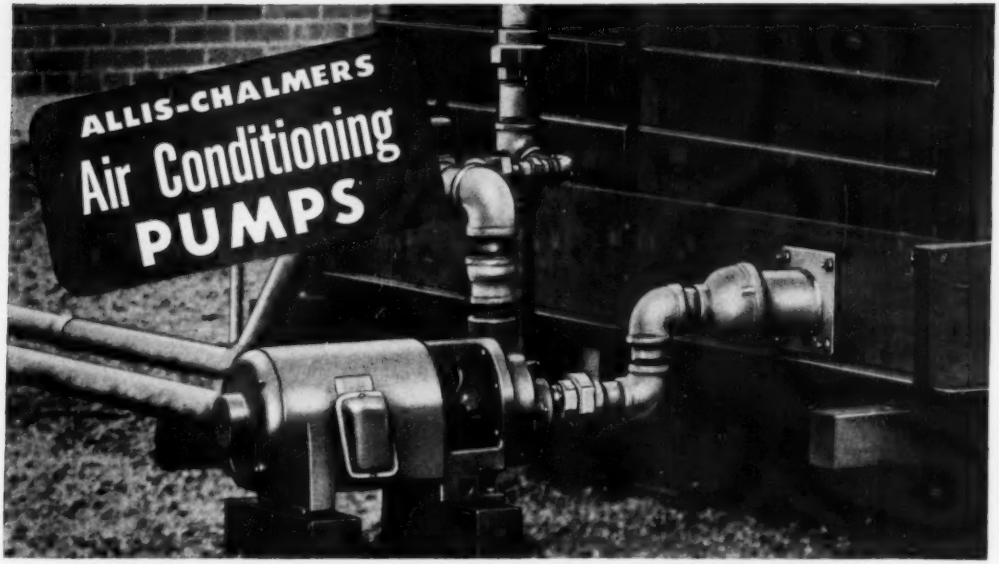
COMPARE capacities and motor horse power as well as size when you choose Circulators and you'll choose Thrush. Here is a complete line of horizontal or vertical Water Circulators to fit every heating job. They offer more for your circulator dollar because they're built better . . . even the smallest sizes are rugged in construction and have larger motors with greater actual output than other makes of equal rating. That means less trouble on the job . . . fewer service calls and greater customer satisfaction. Patented coupling eliminates vibration. Lubrication is sealed in. Ask your wholesaler about them or write Dept. E-5.

H. A. THRUSH & COMPANY • PERU, INDIANA

¾" • 1" • 1¼" • 1½"
1/6 HORSEPOWER

2" • 2½" • 3"
1/4 HORSEPOWER

THRUSH water circulators



Electrifugal Pump Capacity: 10 to 1600 gpm; heads to 525 ft.

SAVE TIME

Figuring Your Air Conditioning Jobs

BE SURE the job is right! Engineering the circulating system is sometimes a problem. It's here that Allis-Chalmers engineers can save you time and effort.

They'll help you solve problems like these:

- How big a pipe will I need?
- How big a pump will I need?
- Where's the best place for the pump?

You're always sure the job will be right.

As for the installation of the pump itself, that's simple. All it takes to mount these Allis-Chalmers pumps is four mounting bolts, a few pipe fittings, two wires and the quiet, smooth-running pump is installed. No maintenance problems either.

For sound engineering . . . pumps that can't be beat . . . and service that's fast and good, call your nearby Allis-Chalmers authorized dealer or district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3667

Electrifugal is an Allis-Chalmers trademark.

For Small Pumping Jobs, Allis-Chalmers Package Pumps with 5 Big Features

1. **Standard Motor** — These fractional horsepower pumps are built with NEMA standard motors of a well-known brand. Built-in thermal protection provided on single phase units.
2. **Mechanical Seal** is used rather than the usual packing gland. Mechanical seal doesn't leak and requires no regular maintenance.
3. **Closed Impeller** is accurately die cast of special bronze. Impeller has smooth surface and high hydraulic efficiency. It is carefully machined and balanced for quiet operation. Impeller can easily be removed with screwdriver and Allen-type wrench.
4. **Rotatable Casing** — Discharge may be placed in any of four directions.
5. **Easy Installation** — Motor and pump are a single complete unit which is simply bolted in place. No extra parts to buy.

ALLIS-CHALMERS

LADISH

Controlled Quality

PIPE FITTINGS

reduce piping
assembly time

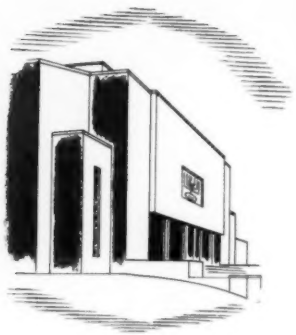
Makeup goes smoother... with less chance for delay... on those piping systems where Ladish fittings are installed. Ladish Controlled Quality makes the difference. By exacting controls over materials and manufacturing processes... Controlled Quality assures uniform weldability through metallurgical integrity, fast assembly through dimensional accuracy and provides a real assurance of ultimate operating economy and complete dependability... reasons why it pays to specify LADISH.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City



Dignity, Decoration and PRACTICALITY *with* uni-flo®

In the new synagog of the Adas Israel Congregation, in Washington, D.C., continuous lines of Barber-Colman UNI-FLO grilles are installed around the ceiling coves, as shown above, to serve *three* purposes. First, they provide outlets for the ventilation system. Second, the continuous lines enhance the beauty and dignity of the decorative scheme. Third, the problem of changing fluorescent light tubes and cleaning cove lighting troughs was solved by a special Barber-Colman hinged grille design. This distinctive unit can be swung up to permit easy accessibility. *Another example of Barber-Colman engineering versatility.*

BARBER COLMAN

BARBER-COLMAN COMPANY • 1228 ROCK ST., ROCKFORD, ILL.

NEW DOOR and PARTITION GRILLE

CUTS COST UP TO 35%

NO SEE-THRU

● Cut-a-way view shows new auxiliary frame. Quickens installation—makes a smoother appearance.

NEVER BEFORE SUCH A DOOR GRILLE FOR THE MONEY. It's so far ahead in design, construction and performance that it's guaranteed to open your eyes.

Skilled Airfoil designers drew, tested and built it to give architects, contractors and engineers the *finest door grille possible*. It's made to OUTLAST—OUT PERFORM.

First—*it's more rugged*. Will withstand heaviest use and abuse for years and years. Second—*it's low in cost*, competitively priced. Third—*it's good looking*. Will add beauty every time it is installed. Fourth—*louvers are absolutely secure*. Do not rattle when door is slammed.

Air Foil

AIR CONDITIONING OUTLETS

FREE!

- **HEAVY GAUGE STEEL. REINFORCED ON EITHER SIDE.**
- **ADAPTABLE TO ANY DOOR WIDTH...MADE TO ANY SIZE.**
- **73% FREE AREA.**
- **ONE-PIECE FRAME.**
- **CUTS DAMAGE AND REPLACEMENT COSTS. NO EXPENSIVE CALL BACKS.**

GET THE COMPLETE INFORMATION ON THESE AND ALL AIRFOIL GRILLES TODAY

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Industrial grilles
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ RUSH information on new door and partition Grilles.
- ☐ Send complete catalog.
- ☐ Send literature on above checked items.

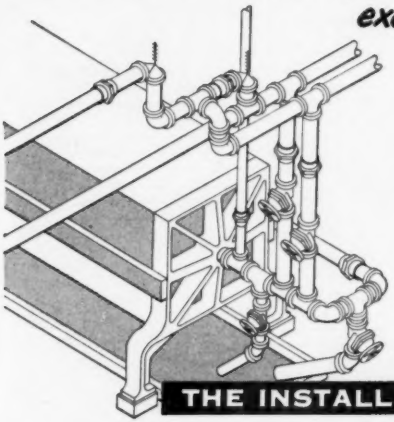
NAME_____

ADDRESS_____

CITY_____ STATE_____

Do Your Valves Last This Long?

...on Semi-Solids, for example



THE INSTALLATION

Crane Packless Diaphragm Valves handling liquid clay to filter presses. Onondaga Pottery Co., Syracuse.

VALVE SERVICE RATINGS

SUITABILITY:	Fluid can't get into working parts
MAINTENANCE COST:	None yet – Big savings indicated
CORROSION-RESISTANCE:	Excellent
SERVICE LIFE:	5 times longer already – no sign of wear
OPERATING RESULTS:	No interruptions – Easier operation – Lower cost
PRICE:	Good
AVAILABILITY:	Stock item – Crane

THE HISTORY

Plug cocks were used in this service before replacing with Crane Diaphragm Valves. But the cocks lasted no more than 2 to 8 weeks. They quickly cut out at the plug and body, damaged by the gritty particles and highly erosive effects of liquid clay at 140 psi. pressure.

After 11 months' uninterrupted service, Crane Diaphragm Valves showed no significant wear or damage resulting from normal operating conditions. They sharply reduced maintenance and replacement costs over plug cocks, and were approved as standard equipment on filter press piping.

THE VALVE

In Crane Iron Body Packless Diaphragm Valves, the Neoprene diaphragm acts as bonnet seal only; is not subject to crushing and rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Choice of fully Neoprene lined or unlined valves. Highly recommended for many common and corrosive services; sludges, slurries, etc. See your Crane Catalog or Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Tap the ever expanding market for this greatest new heating of all

Ceiling radiant heating coils of Bundyweld® Tubing are quickly, economically installed, then plastered over to form *invisible* source of gentle, even radiant heat.

Absence of radiators and registers in room with Bundyweld ceiling radiant heating permits furniture arrangement that suits you best. Gone, too, are usual wall streaks and heavy dust deposits on furnishings.

Warm floors are a *feature* of the house with Bundyweld ceiling radiant heating. Its radiant rays, like the sun's radiant rays, are directed *downward*.

Bundyweld is the *only* tubing double-walled from a single strip. It's steel tubing, copper-coated inside and out. Leakproof, takes high pressures, transmits heat quickly.

Amazing warmth, cleanness, savings— yours with Bundyweld ceiling radiant heating

Going to remodel, build, or buy? Look into the exciting advantages of Bundyweld *ceiling* radiant heating right now. It's the most comfortable, most economical, cleanest heating of all, growing by leaps and bounds in today's housing.

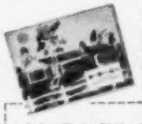
Here is heating that truly *radiates* swiftly downward from the ceiling, gently warming all the room, with even temperatures from floor to ceiling. Here's heating so natural, fresh, and invigorating it's like having the sun in your ceiling.

Clean, economical, too

Draft-free Bundyweld ceiling radiant heating won't spread heavy dust layers over curtains, draperies, furniture. It won't cause hazy films on mirrors, dishes, and glassware. It shortens daily housekeeping chores. Too, Bundyweld ceiling radiant heating eliminates space-eating, wall-streaking radiators and registers; postpones wall washing and redecorating for years.

Bundyweld ceiling radiant heating costs little if any more to install than *forced* hot-air heat. In addition to reasonable first cost, it gives you continuing yearly home-maintenance economies and fuel savings that make it your lowest-cost heating of all in the long run. Most important, of course, the heating comfort is priceless. Get the *full* story. Send for free brochure at right.

Get the *full* story before you decide on *any* heating system. Send for free brochure.



Fascinating, beautiful 20-page brochure gives you complete story of Bundyweld ceiling radiant heating. It takes you behind scenes, explains radiant heating clearly. Gives full story of tremendous advantages, answers dozens of questions, reports views and experiences of people who live with Bundyweld ceiling radiant heating. Send for your copy now.

Radiant Heating Division, Dept. B4
Bundy Tubing Company
Detroit 14, Michigan

Send me free 20-page "Home Owner's Guide to Bundyweld Ceiling Radiant Heating."

Name_____

Address_____

City_____ Zone____ State_____

BUNDY TUBING COMPANY
Detroit 14, Michigan

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING

The boom is on for Bundyweld ceiling radiant heating, newest, most advanced heating method of all.

It's low in cost—often no more than forced-air heating and frequently less. It's easy to install, simple in operation, trouble-free.

Bundyweld ceiling radiant heating is one of the most talked-about house features today. Thousands upon thousands of prospective home owners are clipping coupons from ads like the one at left and sending them in to get information.

Home owners who live with it want nothing to do with any other heating. Builders and contractors who work with it know they have a good thing that's growing bigger every day.

Get the full story on the heating of today and tomorrow. Mail coupon today.

Radiant Heating Division

BUNDY TUBING COMPANY
Detroit 14, Michigan

Many of your prospects, among hundreds of thousands of others, have had their eyes opened by this Bundyweld ceiling radiant heating ad. It's the second in a 4-color, year-round series bringing news of today's fastest-growing, most advanced heating method to the readers of *Better Homes & Gardens* and *American Home*.

SEND FOR FREE LITERATURE! →

Send for Bundy's free 20-page brochure that explains Bundyweld ceiling radiant heating fully and clearly, gives views of people who live with *it* — including a heating engineer and a plumbing and heating contractor who work with *it* every day.

Radiant Heating Division, Dept. HP 352
Bundy Tubing Company, Detroit 14, Michigan

☐ Send me free 20-page consumer brochure on Bundyweld ceiling radiant heating.
☐ I would also like Bundy technical radiant heating bulletin.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

PROMINENT CONTEMPORARY HOSPITALS USING

POWERS *Pneumatic* Temperature and Humidity Control

A Temperature Reaction **is one of the first events in the life of a new born child —and throughout life temperature and humidity affect its comfort and health.**

Little Traverse Hospital, Petoskey, Mich.
Architects: Skidmore, Owings & Merrill, Chicago
Consulting Engineer: Samuel R. Lewis, Chicago
Contractor: Lansing Heating & Ventilating Co., Lansing, Mich.

Powers control provides optimum temperature and humidity **for patients, doctors and nurses, in operating and recovery rooms, delivery and X-ray rooms and nurseries, private rooms and wards.**

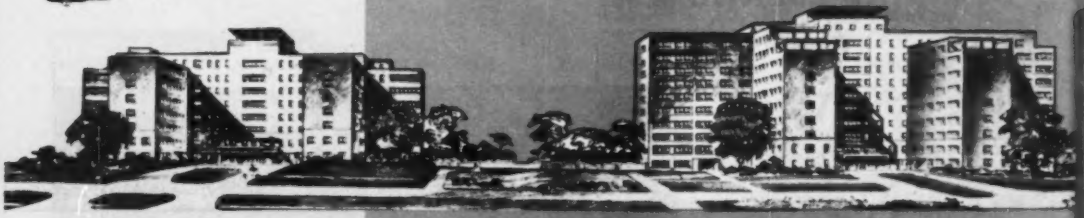
Male Ward Building, Western State Hospital, Fort Steilacoom, Wash.
Architect: A. Gordon Lumm, Tacoma, Washington
Engineer: James B. Notkin, Seattle, Wash.
Contractor: P. S. Lord, Portland, Ore.

Proper Temperature **—external and internal, hastens recovery of patients.**

St. Joseph-Benton Harbor Memorial Hospital, St. Joseph, Mich.
Architects: Fugard, Burt, Wilkinson & Orth, Chicago
Contractor: Northwestern Heating & Plumbing Co., Evanston, Ill.

For Greatest Comfort and Lowest Maintenance Cost Use POWERS Control

Comanche County Memorial Hospital, Lawton, Okla.
Architect: Paul Harris, Chickasha, Okla.
Paul H. Fesler, Hospital Consultant
Engineers: Carnahan & Thompson, Oklahoma City, Okla.
Contractor: Ray F. Fischer Co.



Veterans Administration Hospital, West Haven, Conn.
Left: 400 bed Tuberculosis Bldg., *Right:* 500 bed General Medical & Surgical Bldg.
Architects: Curtin and Riley, Boston, Mass.
Engineers: Corps of Army Engrs., Boston District
Contractor: Raisler Corp., New York City

Morristown Memorial Hospital, Morristown, N. J.
Architects: John H. & Wilson C. Ely, Newark, N. J.
Hospital Consultant: Gerhard Hartman, Ph. D., New York City
Mechanical Engineers: Meyer, Strong & Jones, New York City
Contractor: August Aracc & Sons, Inc., Elizabeth, N. J.

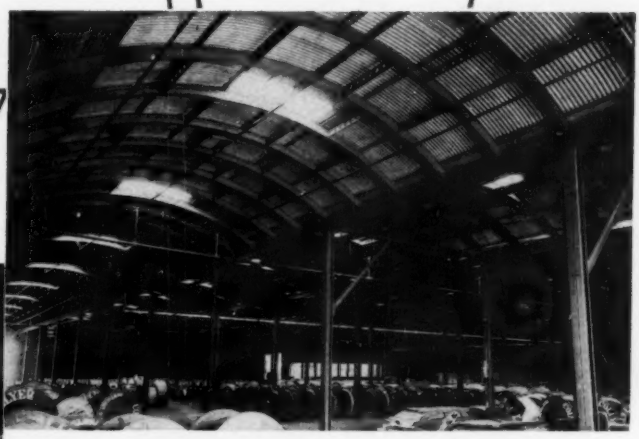
(a75)

THE POWERS REGULATOR COMPANY

Established 1891 — Offices in Over 50 Cities — See Your Telephone Directory
GENERAL OFFICES AND FACTORY—SKOKIE, ILLINOIS

Reliability was a must!

...so Collyer Wire specified quality-controlled **SPANG CW** Steel Pipe



SPANG

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Offices: Grant Building, Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

Whenever reliability is a *must*, careful buyers consistently use Spang CW for their piping needs. For instance, in this unusually-designed warehouse, The Collyer Wire Company of Pawtucket, R.I., insisted on a sprinkler system that would ensure dependable fire protection . . . then *selected* Spang CW Steel Pipe.

There's a good reason why you get more for your money in this *better* pipe. Here at Spang the steels we use must meet the most exact metallurgical standards, and we carefully control temperatures all during forming.

As a result, Spang CW Steel Pipe is a quality pipe that *bends easier* and is *easier on dies* during threading and cutting operations. The pay-off to you is extra-dependability, faster installation and, of course, lower installation costs.

If you would like to see how we make Spang CW, write for Bulletin 370.

Owner: The Collyer Wire Company, Pawtucket, R.I.
General Contractor: Dolben and Co., Boston, Mass.
Sprinkler Contractor: Rhode Island Supply & Engr. Co., Providence, R.I.

IF IT'S PERFORMANCE YOU WANT —
BUY FROM THE PEERLESS

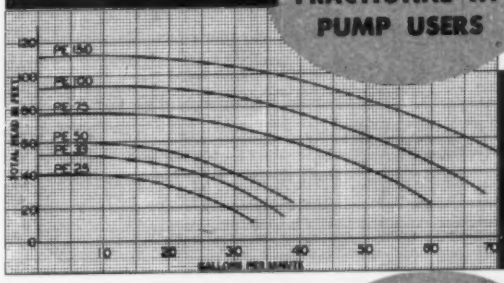
PEERLESS PUMPS

Fluidyne **LINE...**

GET *HIGHEST* EFFICIENCY

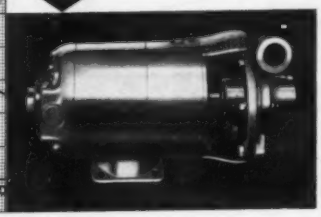
plus COMPACTNESS · ECONOMY · DURABILITY *and* EASY MAINTENANCE

HERE ARE THE RATINGS — **FOR FRACTIONAL HP PUMP USERS**



HERE'S THE PUMP

PEERLESS FLUIDYNE TYPE PE PUMP—¼ TO 1½ HP

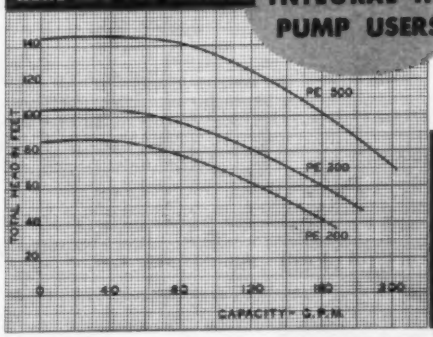


KEY TO CHART

Performance chart showing head capacity characteristics of Peerless Type PE fractional hp Fluidyne pumps at 3450 rpm

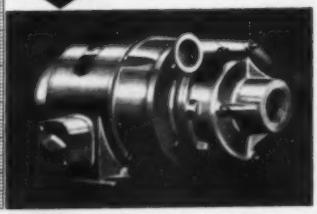
PUMP HP
PE 25—¼ hp
PE 33—⅓ hp
PE 50—½ hp
PE 75—¾ hp
PE 100—1 hp
PE 150—1½ hp

HERE ARE THE RATINGS — **FOR INTEGRAL HP PUMP USERS**



HERE'S THE PUMP

PEERLESS FLUIDYNE TYPE PE PUMP 2 TO 5 HP



KEY TO CHART

Performance chart showing head capacity characteristics of Peerless Type PE integral hp Fluidyne pumps at 3450 rpm

PUMP HP
PE 200—2 hp
PE 300—3 hp
PE 500—5 hp

Both Types - EQUIPPED WITH MECHANICAL SHAFT SEALS

-NO MORE PACKING TROUBLES. ANNOYING, UNSIGHTLY LEAKS ARE ELIMINATED, ONCE AND FOR ALL!

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FOOD MACHINERY AND CHEMICAL CORPORATION
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HPAC

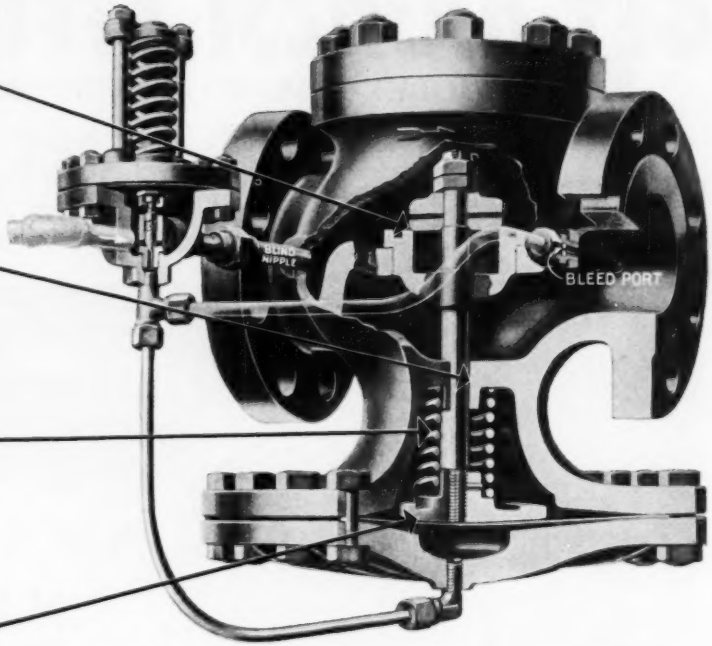
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

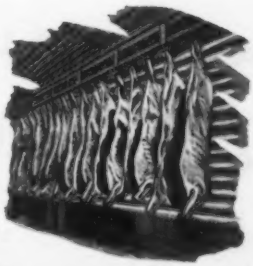
MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

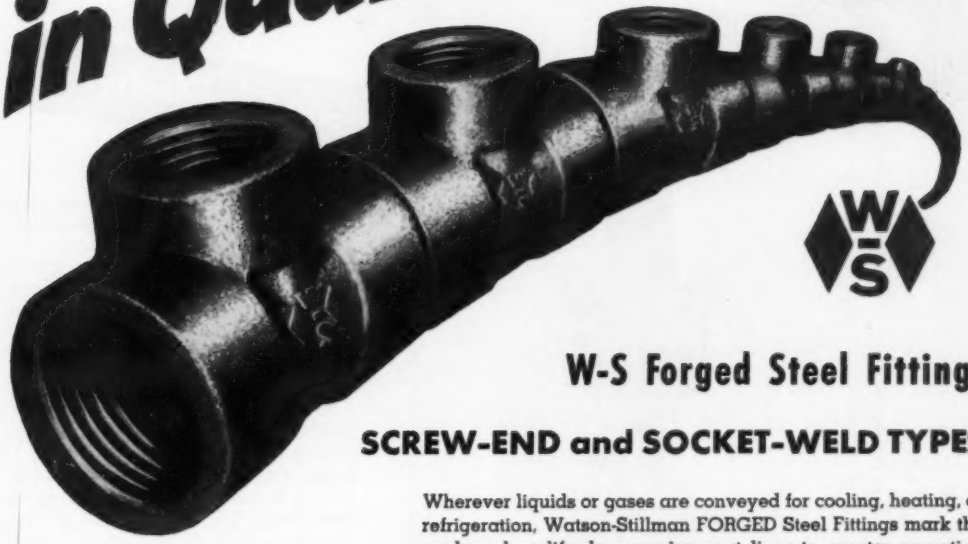
SE-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

Quality... in Quantity

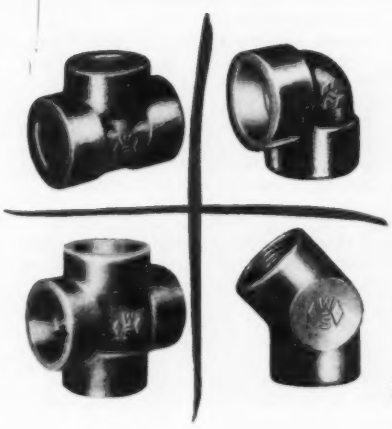




W-S Forged Steel Fittings

SCREW-END and SOCKET-WELD TYPES

Wherever liquids or gases are conveyed for cooling, heating, or refrigeration, Watson-Stillman FORGED Steel Fittings mark the modern, long-life, low *service*–cost lines to greater operating economy.



Quality—in Quantity—has earned and sustained the Watson-Stillman position of first-to-see when industry seeks a solution to a specific fittings problem. Despite an enormous increase in the use of its low *service* cost fittings, Watson-Stillman has never relaxed its concern for the metallurgical aspects of product development.

First to identify itself with the establishment of standards for the properties of special purpose fittings alloys, Watson-Stillman technicians continue in close association with the engineering research efforts of a score of basic industries . . . will be glad to lend a hand on *your* next fittings problem.

9-M-3

• **Stronger** • **Smaller** • **Lighter** • **Tighter**
• **More Uniform** • **Lower Service Cost**

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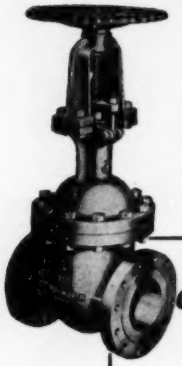
Designers and Manufacturers of Forged Steel Fittings, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke



Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2" to 24") insure tightness and maximum packing life – costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion – they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated – not flange type. No recess exists at back of ring – hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

IF YOU WANT TO

Bring Steam Costs Down

CONSIDER THIS
Factory-assembled, Self-contained B&W Integral-Furnace Boiler, Type FM

- Saves erection time and cost
- Meets wide range of services
- Handles quick load changes • Fast steaming • Low maintenance
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It Is Easily Shipped from Us to You

By Truck . . By Rail

Set it down where you want it . . . Set it up in a hurry

There's no law against buying more than one FM unit if you need BIG BOILER capacity. Many companies have, and pocketed the money they would otherwise have spent tearing their buildings apart to put the boiler in. Ask your nearest B&W man to explain the economical service you can expect from Type FM boilers . . . or send for Bulletin G-72.

THE BABCOCK & WILCOX COMPANY
BOILER DIVISION
85 Liberty Street, New York 6, N. Y.

BABCOCK & WILCOX

G-544

The thermostat you see on the pillar in the photograph of Gordon's purse and glove section, right, is one of seven on the ground floor. Located near the main entrance, it gives area control and aids the entrance thermostat in compensating for cold winter drafts and hot summer blasts.

Why Honeywell Customized Temperature Control is a sound modernization investment for American Business

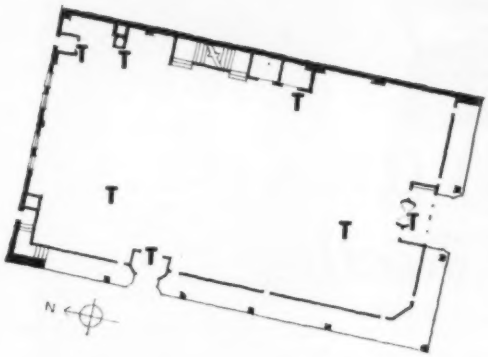
Specially designed system provides year-round comfort that pleases customers and employees—while saving 25% on fuel

You'd have to look a long time to discover a more "typical" American department store than Gordon's in Gary, Indiana. And you'd have to look a long time, too, to discover one that was more genuinely comfortable—all year 'round.

For providing customers and employees of Gordon's Department Store with a near-ideal "climate"—no matter *what* the weather—is a Honeywell Customized Temperature Control System.

And what's more, since this customized control system was installed, the management has experienced a 25% annual reduction in fuel bills.

The intangible good will and efficiency benefits derived from customer and employee comfort, plus the very tangible benefits derived from fuel saving make Honeywell Customized Temperature Control a mighty sound investment.



The right number of thermostats for perfect comfort

As shown by the large **T**'s above, one of the keys to comfort in the Honeywell Customized Temperature Control System is thermostat location. Notice how this works on the plan—compensating for exposure, use and occupancy differences. Notice how special thermostats guard entranceways, make up for elevator shaft heat loss and give general area control.

Instrumental in planning the installation of Honeywell Customized Temperature Control in Gordon's Department store were Gary architect I. M. Cohen; William Goodman, consulting engineer, Chicago; William H. Stern, Gary, general contractor; Klingaman & Sons, Gary, air conditioning and heating contractor.

A special thermostat in the women's coat and suit department on the third floor helps make sure customers don't become uncomfortably warm when trying on heavy garments. Other Honeywell thermostats located in other third floor areas helps meet particular comfort demands of a variety of departments.

Office workers, too, are pleased with the year-round comfort Honeywell Customized Temperature Control provides. Before the system was installed, office sections—especially when they had no outside windows, as in the case of the one above—often became uncomfortably warm. Now they almost never do.

For Comfortable, Even Warmth in New or Existing Public Buildings, Specify Honeywell Customized Temperature Control

Whether it's a store, factory, office, or any size public building—new or existing—there's a Honeywell Customized Temperature Control System to meet your clients' heating and ventilating problems.

Once equipped with a Honeywell Customized Temperature Control System, they'll have the right kind of controls to keep their employees, customers and tenants comfortable—and they'll save fuel besides.

For facts on Honeywell Customized Temperature Control, call your local Honeywell Office. There are 91 across the nation. Or mail coupon today.

"In my opinion, Gordon's has the finest possible comfort," says William Goodman, consulting engineer.

"The special system was designed to cover all comfort factors—occupancy, use and exposure. It does just that—superbly well—as customer and employee reactions prove."

MINNEAPOLIS-HONEYWELL
Dept. HA-5-109, Minneapolis 8, Minnesota

Gentlemen: I'm interested in learning more about your Customized Temperature Control System for public buildings.

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MINNEAPOLIS
Honeywell

First in Controls

LOOKING AHEAD . . .

C. M. Burnam, Jr. **Editor**

The subject of air conditioning has all sorts of ramifications! These days it's a plant and building service so basic to the needs of industry and business—and home-life, as well—that it leads one into a variety of unexpected considerations.

For example, a contractor who has had a lot of experience in the application and installation of air conditioning for suburban shopping centers—a popular type of commercial development in recent years—presents this thought: Based on his experience, he says that the owner of a shopping center can often expect a greater return on his investment for supplying air conditioning to his tenants than the return on the space itself provided by that investment.

Another interesting air conditioning angle this same contractor suggests is that, with any great development in an area, the use of ground water as the winter heat source for heat pump installations and the use of the same ground water in summer air conditioning jobs may be of considerable importance.

In winter the general temperature level of the ground water would be lowered, as heat is taken from it by the heat pump. In summer, using the ground water either for direct air cooling or as the condensing medium for refrigeration compressors, its temperature would tend to be restored—thus again becoming of a suitable temperature to be utilized the following winter for heating by means of the heat pump.

* * * * * * * * * * *

A woman we know socially was going on at great length the other evening about the "open the window—shut the window" fight in the office where she works. From the violence of her remarks, we gather that a good bit of otherwise productive time goes into a battle where victory can never be won—except by the employer with better heating control in the winter and better control of summer conditions. We're positive he'll save money by doing whatever needs to be done.

in Heating

The rate at which buildings heat up after the steam is turned on in the morning affects the operation of a central heating plant, fuel conservation efforts, and the results and satisfaction achieved. The heating-up rate is thus both an operating as well as a design problem for heating engineers. The heating-up rate for a building is not determined, however, by picking a value off a chart or from a table. An article being prepared for early publication in HP&AC will present information on an analog study of the heating-up of buildings.

in Piping

While as yet we can't schedule for any definite issue an article that's been promised for our pages, we'd like to mention it now. The author is responsible for all heating, piping and air conditioning services at a very busy and expanding plant. The article covers the problem of increasing the chilled water flow in an extensive piping system. Readings were taken, and a complete pressure drop gradient plotted—along with an "ideal" pressure gradient. As a result, a chemical cleaning service was utilized—after which pressures hit the ideal curve on the nose. We're sure the article is going to be interesting and valuable.

in Air Conditioning

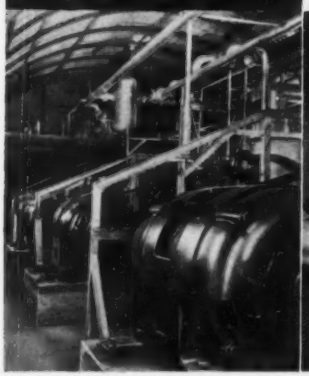
Generally speaking, there is no one particular duct layout for a specific case. Different engineers use different layouts for various reasons. However, it is possible to analyze a duct layout more closely than often happens under the pressure of getting plans completed. An article soon to appear in HP&AC tells how this may be done and the advantages of doing it.

EVERY MONTH . . *in HP&AC: The Journal Section of The American Society of Heating and Ventilating Engineers . . . Back-of-the-book departments on equipment, trade literature, new books and reports, meetings and conventions, news notes . . . Sam Lewis' Page, Data Sheet, "Open for Discussion", The Law and Your Profits, The Editor's Pages.*

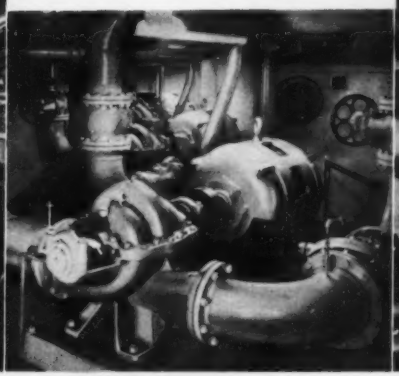
Large or Small...

Century MOTORS

Are Designed to Provide All the Performance That Is Built Into the Machines They Drive



Century 125 H.P. motors driving ammonia compressors for ice for the Falcon Dam, which is under construction on the Rio Grande River.



Century 125 H.P. motors on circulating pumps for condensing units. They serve the refrigeration system of a large department store.

Century 125 H.P. motors on circulating pumps for chilled water. Used in the same department store,

Here are some typical examples of equipment powered by large Century motors, which were application engineered for TOP PERFORMANCE.

Matching the operating characteristics of your equipment is made easy through Century's wide line of single phase, polyphase and direct current motors to choose from. They are made in many types, ranging in size from 1/8 to 400 horsepower, with literally hundreds of specifications adaptable to specific applications.

Get Top Performance of your equipment through skillful motor application by specifying Century motors on the equipment you buy and for replacement.

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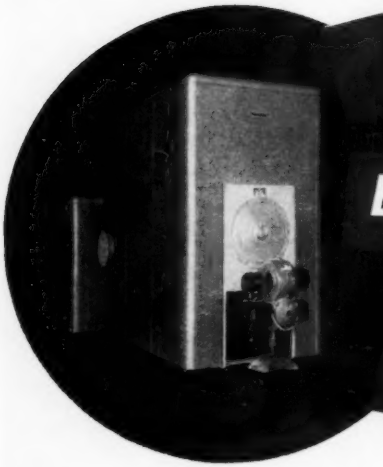

J-C BIG furnaces for BIG heating requirements

Today's approved civilian and defense building programs demand heating systems that save money, space, installation time and critical materials. Jackson & Church is meeting this demand with Job-Specified PoweRated* and suspension warm air heating and ventilating systems. Floor type models are available in a range of sizes from 380,000 to 3,800,000 Btu output and space saving suspension models from 112,000 to 450,000 Btu output per hour to meet all big heating requirements.

Our engineering department is at your service to assist with heating layouts.

See your local dealer or write today for details.

*PoweRated . . . designed to meet specific Btu requirements.

. . . America's Largest and Most Complete Warm Air Heating Line . . .

J-C

JACKSON & CHURCH COMPANY, SAGINAW, MICHIGAN

WORK WELL DONE SINCE '81

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Engineered for efficient flow

EFFICIENT FLOW in piping systems is worth striving for . . . it saves kilowatt-hours and avoids over-investment in equipment. That's why, on this TUBE-TURN Welding Elbow, so much engineering attention is devoted to true circularity, smooth inner walls, and exact radius. They all contribute to minimum flow resistance and reduced pressure loss.

When you specify TUBE-TURN Welding Fittings and Flanges you are specifying careful engineering. Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Write Dept. A-5 for free booklet "Pipe and Fitting Materials" which gives specifications, properties and welding procedures for various materials.

Be sure you see the double "tt"

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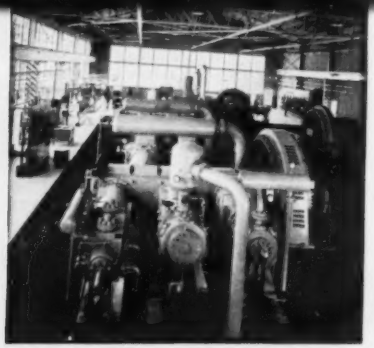
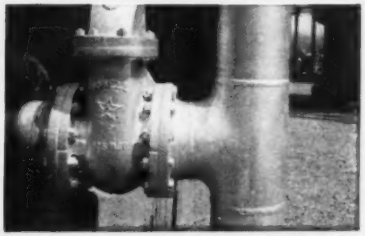
Where leakproof piping is imperative...
TUBE-TURN Welding Fittings
are on the job!

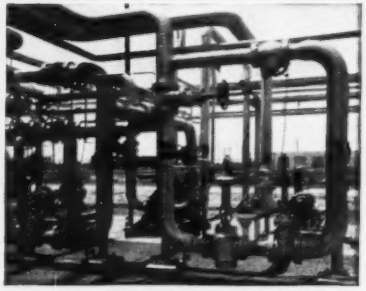
Piping at new Mississippi Chemical Corporation plant handles explosive gases and acids at high pressures. That's why leakproof welded piping was specified, and TUBE-TURN Welding Fittings and Flanges used throughout. Process piping handles hydrogen, nitric acid, anhydrous ammonia, etc. Engineering and construction of entire plant, which produces synthetic nitrogen fertilizer, was handled by The Girdler Corporation.



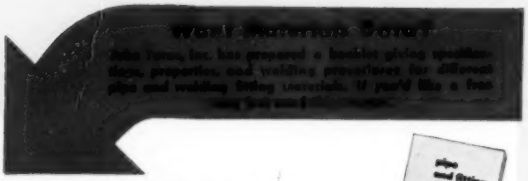
Design and installation of piping was simplified by obtaining all the necessary types of welding fittings from one reliable source. TUBE TURNS, INC. offers the world's broadest line of welding fittings and flanges—available in a wide range of types, sizes, and more than 40 different alloys.



125-lb. cast iron valve is secured to process line with TUBE-TURN Welding Neck Flanges. True circularity and uniform wall thickness of TUBE-TURN Welding Fittings, such as Welding Tee (right) and Welding Reducer (left) assure proper fit and speedy fabrication. Welders know they can depend on accurate line-up with TUBE-TURN Welding Fittings.



Welded piping using TUBE-TURN Welding Fittings keeps flow resistance and pressure drop to a minimum —an important consideration where so much piping is used. The complete Mississippi Chemical plant is noteworthy for high efficiency throughout . . . unit energy input is lower than in any other similar plant.



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TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

"Our *Powermaster* Boilers are dependable, efficient, easy to service, and economical to operate"

William H. Wagner
Plant Engineer
Blue Bird Silk Mfg. Co.

Alfred J. Sidler
Plant Manager
Blue Bird Silk Mfg. Co.

20% Saving in Steam Cost at York, Pa. Manufacturing Plant

William H. Wagner, Plant Engineer of the Blue Bird Silk Manufacturing Company, knows the problems of generating high-pressure steam 24 hours a day, 365 days a year. And he knows how serious it can be for a busy manufacturing plant if there is trouble or failure in the boiler room. That's why, two years ago, the company replaced their old-fashioned coal-fired boilers with two 200 h.p. POWERMASTER packaged automatic boilers, burning #6 (Bunker C) oil. Here is what they found:

- The cost of producing steam for processing and heating dropped 20%.
- The steam produced now is much dryer.
- The POWERMASTERS respond very rapidly to variations in load.
- Maintenance has been negligible.

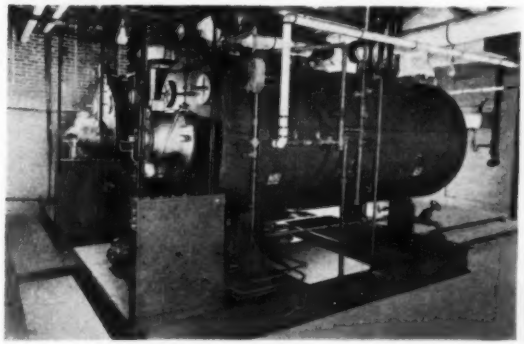
Little wonder that Alfred J. Sidler, Plant Manager, says, "If we had it to do over again, we would certainly buy POWERMASTERS."

No other packaged automatic boiler gives you *all 3 advantages of the Powermaster:*

1. SAVE FUEL—because the special *Powermaster* burner design gives you top efficiency when operating anywhere between 30% and 100% of capacity.
2. SAVE IN MAINTENANCE and clean-up time. Complete combustion of fuel gives practically smokeless and carbon-free operation. The burner has *no* moving parts to wear out . . . or to be cleaned daily.
3. CHANGE FROM OIL TO GAS (or gas to oil) in just a few minutes. Burn light oil, heavy oil, or gas—whichever is cheaper. You no longer need depend on one source of fuel supply.

Write for this Catalog

To get complete information about this modern packaged automatic boiler for steam or hot water, write for *Powermaster* Bulletin 1218. We'll be glad to put a copy in the mail for you.



These 200 h.p. POWERMASTER packaged automatic boilers have been operating round-the-clock for more than two years at the Blue Bird Silk Manufacturing Company, York, Pa. Burning #6 oil, they produce a total of 13,800 pounds of steam per hour.

Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 h.p.; pressures to 250 psi.

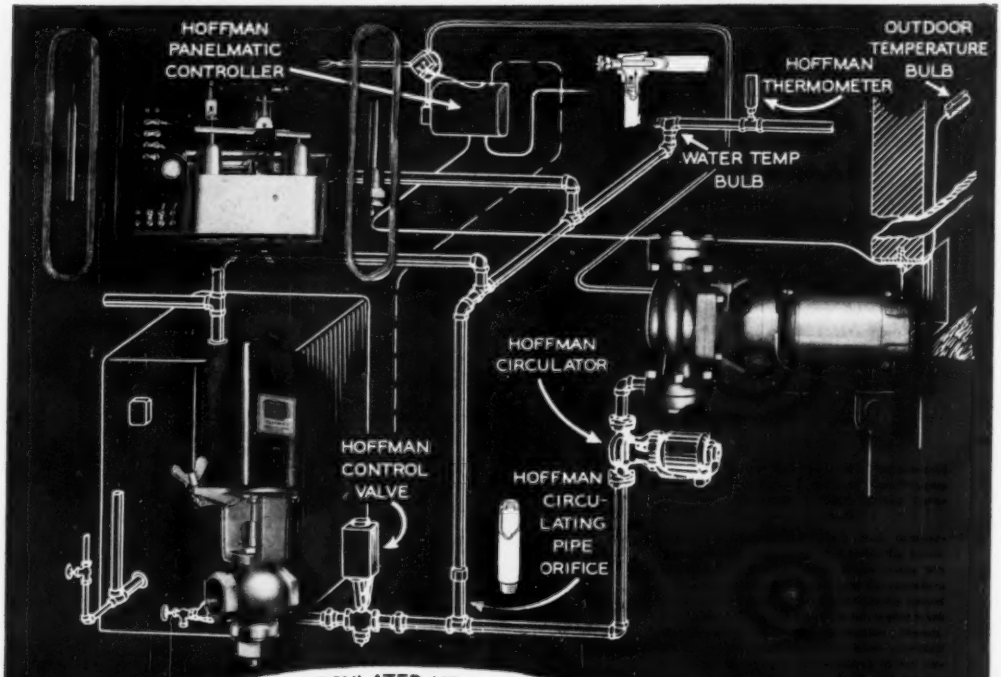
ORR & SEMBOWER, INC.

Established 1885

990 Morgantown Road, Reading, Pa.

HOFFMAN PANELMATIC *Hot Water System Controls*

AUTOMATICALLY BALANCES WATER TEMPERATURE WITH WEATHER



CONTINUOUSLY CIRCULATED HOT WATER SYSTEM

Designed especially for AUTOMATIC HOT WATER

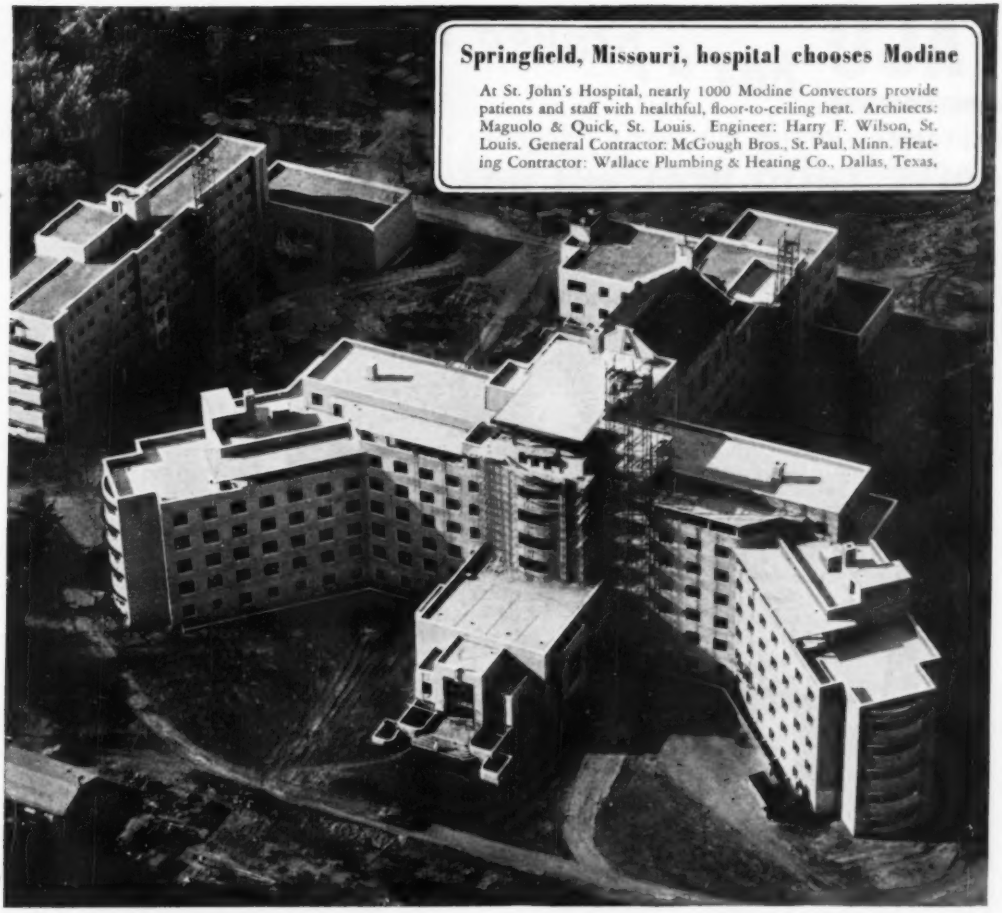
The Hoffman Panelmatic Controller is based on the fact that for every Outdoor Temperature there is a corresponding Supply-water Temperature, which must be ***automatically maintained*** in the heating units. The correct Supply-water Temperature, in the case of a panel heating system, or the output per sq. ft. EDR in the case of other forms of radiation, must be specified by the Architect or Engineer for ***one Outdoor Temperature***. The Controller then ***automatically*** adjusts the Water Temperatures to balance any other outdoor conditions encountered. The following table illustrates several sets of conditions for a panel heating system.

Architect or Engineer to Specify			Factory Sets Controller		Controller Automatically Furnishes Supply Water at Temperatures Correct for Any Outdoor Temp. as Listed Below				
					Outdoor Temperature °F.				
Design Temp. °F.	Supply Water °F.	Room Temp. °F.	Scale No.	Supply Water °F. at Outdoor 32 °F.	−10	0	+10	+30	+50
					SUPPLY WATER TEMPERATURE °F.				
−10	150	70	11	108	150	140	130	110	90
0	150	70	13½	114	—	150	139	116	94
+10	140	70	14	115	—	—	140	117	94
−10	140	70	9	104	140	132	123	106	88
−10	160	70	13	113	160	147	137	115	92

When the outdoor temperature reaches 65°F., the Circulator automatically stops. The 65° factory setting was chosen because it is the basis for calculating degree days. If a different cut-out temperature is desired, it can be easily adjusted to individual requirements. Occasionally the actual heat loss differs from the calculated loss due perhaps to changes in construction. The Panelmatic Controller can be easily re-adjusted after installation according to simple, definite instructions furnished by the factory. Technical literature describing the Panelmatic System and sample specifications, gladly furnished on request.

PIONEERED BY HOFFMAN

HOFFMAN SPECIALTY COMPANY, Dept. B-4, 1001 York St., Indianapolis 7, Ind.



Springfield, Missouri, hospital chooses Modine

At St. John's Hospital, nearly 1000 Modine Convectors provide patients and staff with healthful, floor-to-ceiling heat. Architects: Maguolo & Quick, St. Louis. Engineer: Harry F. Wilson, St. Louis. General Contractor: McGough Bros., St. Paul, Minn. Heating Contractor: Wallace Plumbing & Heating Co., Dallas, Texas.

America's finest buildings use America's finest convectors

Choose from three enclosure types in Standard and heavy-duty Institutional models for free-standing, recessed or wall-hung installation

FOR today's hospitals, superior heating performance must be teamed with subtle styling and long-life construction. On all counts, Modine Convectors meet exacting professional standards. That's why more and more Modine Convectors are being specified by leading architects and engineers. For full information on heating at its finest, call your Modine representative. You'll find him listed in your classified phone book. Or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis.

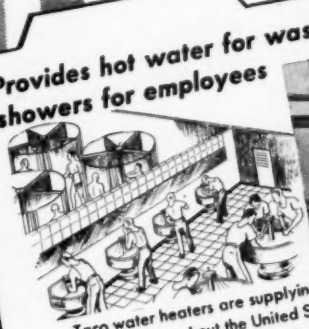
Modine CONVECTORS

TACO has a proved record of helping

FACTORIES • OFFICE BUILDINGS • SCHOOLS • HOSPITALS • CHURCHES • STORES

SOLVE THEIR HEAT and HOT WATER PROBLEMS . . .

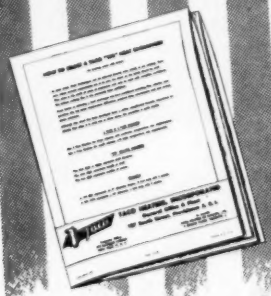
Provides hot water for wash fountains and showers for employees



Taco water heaters are supplying abundant low cost hot water in industrial plants throughout the United States. Our more than 30 years' experience in this field is a big help to those with hot water heating problems.

Heats entire building with heat formerly thrown away

A large industrial user of steam was dumping the condensate from their steam processing into a creek. Now, thanks to the 3 Taco heat exchangers on the right, they're reclaiming enough to heat the 220' x 560 building shown above. Taco products can perhaps do a similar service for you.



ENGINEERS . . . WRITE FOR

simplified selection chart for sizing Taco water heaters under any conditions such as steam pressure, temperature rise and pressure drop.

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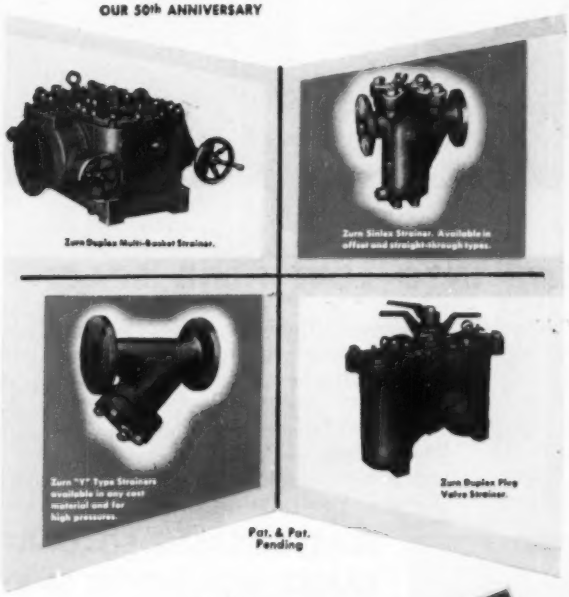
To Permit High Rates of Flow With Remarkably Low Pressure Drop

ZURN LOW PRESSURE DROP STRAINERS

OUR 50th ANNIVERSARY


Zurn Duplex Multi-Basket Strainer.
Zurn Sinlex Strainer. Available in offset and straight-through types.
Zurn "Y" Type Strainers available in any cast material and for high pressures.
Zurn Duplex Plug Valve Strainer.
Pat. & Pat. Pending

IMMEASURABLY IMPROVE THE HANDLING OF FLUIDS (OIL, CHEMICALS, WATER) THROUGH PIPE LINES

Now, a reduction of pressure loss can be obtained by the installation of Zurn Engineered Strainers. Design improved for correct circularity, smooth inner walls combined with correctly sized and perforated baskets reduce pressure loss and afford maximum protection for all types of mechanical units connected with pipe lines.

Zurn Strainers, are held to close manufacturing tolerances for materials, shape, and dimensions assuring the utmost in strength and safety. Zurn Strainer applications include fluid handling lines for lubricating and fuel oil, and oil during the refining process; a wide range of chemicals produced and used by the various process industries; public utility power plants; power stations; industrial plants; municipal water systems; ships and high temperature, high pressure installations. Zurn Fluid Handling Engineers are available for consultation on your fluid handling problems.

Write for Pipe Line Strainer Manual No. 951, including previously unpublished pressure drop data.

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In Canada: Canadian Zurn Engineering Ltd., Montreal, P. Q.

J. A. ZURN MFG. CO.
Industrial Division; Erie, Pa., U. S. A.
Please send me Pipe Line Strainer Manual No. 951

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Please attach to your business letterhead—Dept. HP

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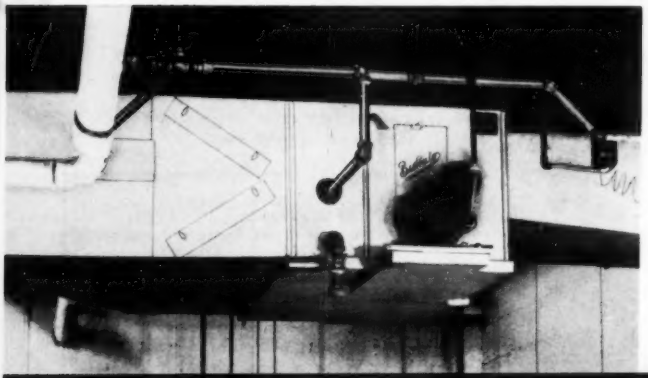
"Buffalo"

Tips on Better

Choose the Cabinet Unit

FLAT FLOOR UNIT FITS INTO LOW HEAD SPACE

Above is a "Buffalo" Model "PCW" Cabinet which heats, cools, humidifies and washes the air, as desired. It is a complete air conditioning unit with preheat coil, water spray chamber, cooling coil, eliminator section, tank, reheat coil and blower section . . . yet all compactly arranged for extremely low height requirements. This is one of a wide variety of "Buffalo" cabinets to meet many installation requirements. Any or all air conditioning functions may be had in the different models of "Buffalo" Air Conditioning Cabinets shown on these pages.



FLAT SUSPENDED UNIT TAKES NO FLOOR SPACE-

Where there is no floor space available, or where there is unused space under a portion of a ceiling, "Buffalo" Flat Suspended PC Cabinets are ideal. They are easily walled in, for a finished job. Available in capacities from 875 to 22,000 cubic feet of conditioned air per minute.

AIR CONDITIONING CABINETS

AIR CONDITIONING

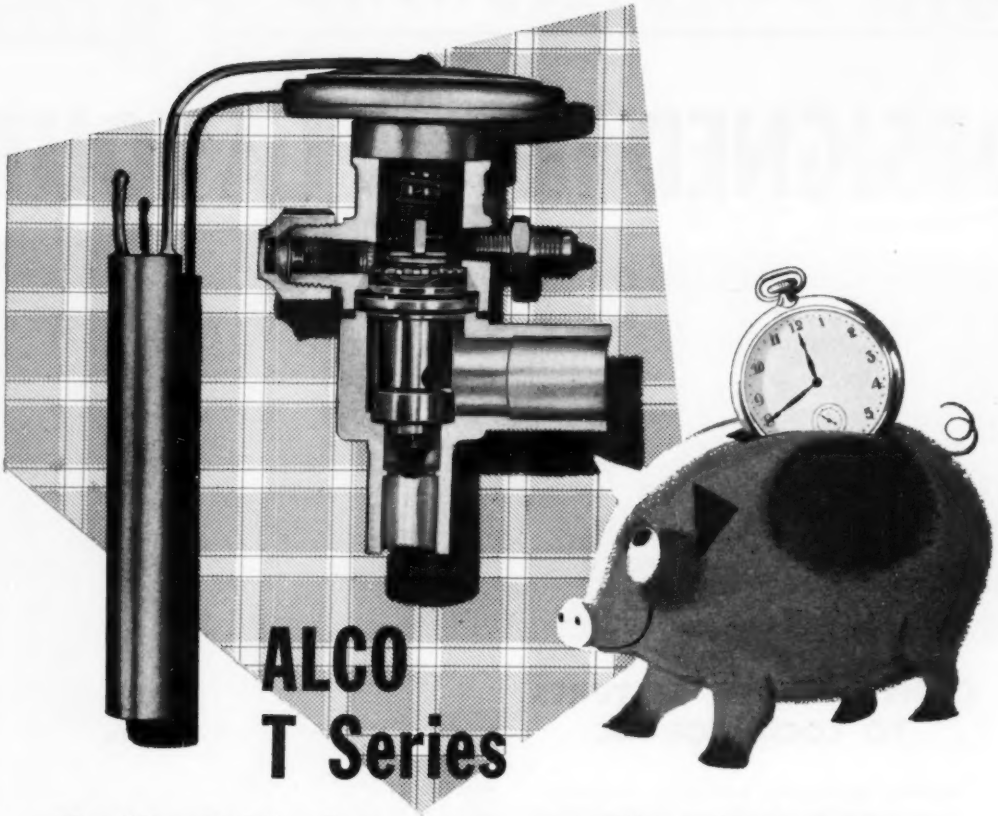
DESIGNED for your LAYOUT

CONSTRUCTION FEATURES TO LOOK FOR—

Important construction features in an air conditioning unit are: the pump, coils, fans, spray nozzles and casing. "Buffalo" units are equipped with "Buffalo" Pumps, "Buffalo" mixed-flow, hollow-shaft Fans, "Buffalo" Non-Clogging Spray Nozzles, Aerofin coils and heavy, durable metal casing. A further feature of these units is their standardized, sectional construction. This permits moving the units into buildings through standard doorways, and greatly simplies inspection, servicing and repairs. WRITE FOR BULLETIN 3703-A for complete information on construction of these units.

VERTICAL MODEL SAVES FLOOR SPACE

Taking very little floor space, the "Buffalo" VPC cabinet provides any desired air comfort function. The flat type Hi-Velocity Filters save additional space. Recently redesigned, "Buffalo Model "G" Air Conditioning Units have streamlined appearance and standardized parts for flexible combinations convenient to knock down for shipment and easy assembly.



ALCO T Series

the "Scotch" valves—save you time two ways

EASY TO SERVICE ON THE LINE—remove two cap screws; lift off power assembly; take out the cage assembly. Now you're ready to inspect and clean the valve or replace parts.

EXTERNAL SUPERHEAT ADJUSTMENT—just remove seal cap on side of the valve and turn adjusting stem. It's that simple!

Available with internal or external equalizer. Capacity from 1/2 to 50 tons "F-12". There is a T-Series Valve for all temperatures and all refrigerants.

For further details, send for Bulletin 171.

SEE YOUR ALCO WHOLESALER!

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

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ALUMINUM MONEL* BRASS STEEL

NEED METALS?

INCONEL* STAINLESS STEEL NICKEL* COPPER

Sheet, Plate, Tube, Pipe, Wire, Rod and Bar, Extrusions, Structural Shapes . . and the following INDUSTRIAL PRODUCTS: Fasteners, Tube Fittings, Pipe Fittings, Valves, Silver Brazing Alloy, Welding Material, Solder, Castings, Tube Expander Equipment, Liquid Plastic Protective Coating, Metallic Caulking Compound, Aluminum Metal Trim, Waterproof Barriers, Nails, Handrail Fittings, Low Melting Alloys, Aluminum Jacketing, Wire Cloth and Rope, and "O" Rings.

Precision Equipment for Shearing and Slitting.

*Not stocked in Kansas City or St. Louis territories.

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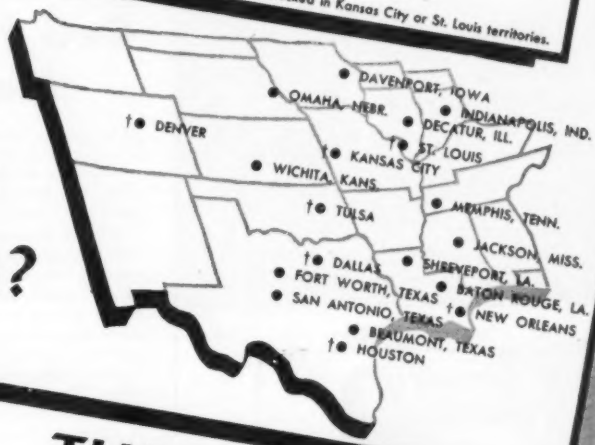

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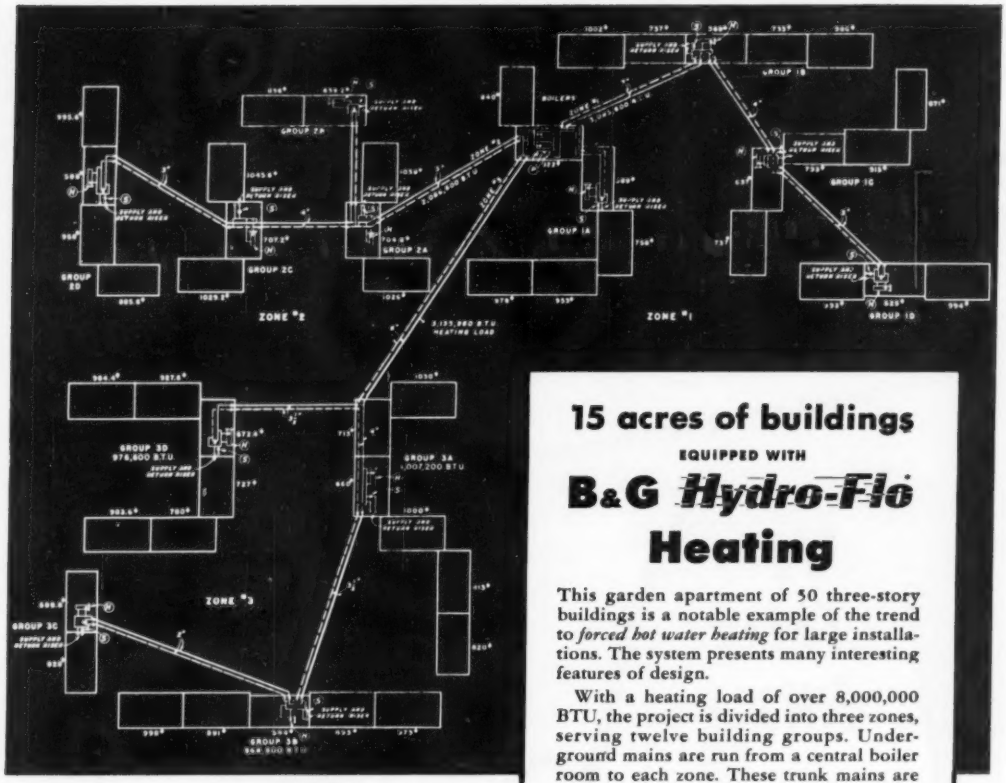


15 acres of buildings

EQUIPPED WITH

B&G *Hydro-Flo* Heating

This garden apartment of 50 three-story buildings is a notable example of the trend to *forced hot water heating* for large installations. The system presents many interesting features of design.

With a heating load of over 8,000,000 BTU, the project is divided into three zones, serving twelve building groups. Underground mains are run from a central boiler room to each zone. These trunk mains are of two-pipe design while the branches to the various building groups are single main circuits equipped with B & G Monoflo Fittings. The Monoflo mains are carried in the roof space and feed down to the radiation.

A novel piping arrangement permits the heating of each building group to be individually controlled. B & G Universal Pumps in the boiler room are used as primary pumps, for circulating the trunk mains. The Monoflo mains are independently circulated by secondary B & G Boosters. This method of pumping isolates the branch circuits so that they are not affected by the pressure head developed by the primary pump.

Domestic hot water is provided by a B & G Tankless Heater located in each building group. Water from the heating trunk main is pumped through the Heater by a B & G Booster.

Send for Catalog of B & G Hydro-Flo Heating Products.

The B & G Hydro-Flo equipment illustrated above is used in the installation described here.

BELL & GOSSETT COMPANY

Dept. CM-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto

*Reg. U. S. Pat. Off.

THE EDITOR'S PAGES

A FRIEND OF OURS — an executive with a manufacturer of heating and air conditioning equipment — has recently moved into his company's new and completely air conditioned offices. He's so enthusiastic about the comfort — and summer's not yet here — you'd think he'd never even heard about air conditioning until yesterday . . . . . He thinks any businessman who tries to get along without air conditioning these days is crazy, and we agree. People are the important asset of any business — in some kinds of businesses, just about the only asset — and whatever investment aids their productivity is a sound one (especially these days) . . . . . We all know that when we're doing work involving any sort of mental activity, we do it better and more efficiently when we're physically comfortable. . . . . We all know, too, that one of these days there probably won't be such a thing as an un-air-conditioned office. . . . . Let's do all we can to hasten that day!

C. WALLACE MARKS 50th ANNIVERSARY

THE C. WALLACE CO., of Dallas, is celebrating this spring the 50th anniversary of its founding in 1902 by Carl Wallace. Several members of the Wallace family — including Sam P. Wallace and Frank E. Wallace, the founder's two sons, and Carl Preston Wallace, a grandson — are active in the multi-million dollar concern.

A colorful booklet has been issued to mark the anniversary and to honor the founder, who is now retired from active duty. It includes pictures of 54 installations, and lists more than 200 of the company's major heating, air conditioning and plumbing jobs in various categories.

"QUOTE"

"Almost *two million* of us were traffic casualties in 1951. Specifically, 37,100 persons were killed and 1,962,600 injured in auto accidents last year.

"The enormity of this toll is difficult to digest. Out of all context, a total of two million broken bodies from any cause is beyond description. For a sharper focus on two million deaths and injuries, think of them in terms of one or two at a time in accidents on roads in every corner of the country.

"More to the point, think of them in terms of your own circumstances. Think of them when *you* drive or walk."—THE TRAVELERS.

J. R. KELL HEADS IHVE

J. R. KELL — who has written articles on air conditioning the House of Commons and on high pressure hot water systems for HPAC — was recently installed as president of the Institution of Heating and Ventilating Engineers (British "counterpart" of the American Society of Heating and Ventilating Engineers.)

Mr. Kell, a consulting engineer, emphasized in his presidential address the institution's concern with all types of heating — electricity, gas or any other form of energy, including atomic. He suggested the need, too, for more papers on the everyday problems confronting designers and installers, and indicated the need for further study and review of the IHVE's position insofar as research is concerned.

N.Y. TENANTS GET HOT ABOUT APARTMENT HEAT

THE LOT OF TENANTS in many of New York's more than 1.6 million apartments is apparently not a very comfortable one — at least not during the winter.

Complaints about the heat — or lack of it — from disgruntled New Yorkers pour through the city's department of health at rates ranging from 150 calls on a mild day to 1200 calls during a cold snap.

The lack of proper apartment heat in the early morning and evenings is the commonest complaint lodged, according to an analysis by Minneapolis-Honeywell of last winter's calls to the department. The heaviest deluge of calls comes between 9:00 a.m. and 10.30 a.m., when 25 percent of the tenants complain of chilly apartments when they get up.

The study also showed that of those complaining about low evening temperatures, about 5 percent request heat after 10:00 p.m. (the legal time limit for heat in multiple dwellings in the city.)

On the other hand, about 20 tenants a week call to say that they have too much heat and their apartments are "drying out."

Many complaints originate in two-family houses where a single thermostat in the landlord's quarters regulates the heat in that of the tenant's.

ISSUES MEMO ON COOLING TOWER LUMBER MAINTENANCE

THE COOLING TOWER Institute, Basking Ridge, N. J., has issued a memorandum on the maintenance of cooling tower lumber — a progress report of the CTI's technical subcommittee No. 3.

The work of the subcommittee, in cooperation with the California Redwood Association, has resulted in establishing recommended practices in the operation of cooling towers. It should be emphasized that these recommendations should not be taken as rigid rules to be followed under all conditions, since certain installations are of such a nature that existing operating practices cannot be changed.

The following general recommended practices for maintenance of cooling towers are presented by the subcommittee in the light of the best knowledge to date:

1) For the control of delignification and, possibly to some extent, fungal infection, cooling tower water should be kept at a pH preferably between 6.5 and 7.5. Although pH is not the sole criterion for delignification, conformance within the above limits should eliminate the constituents in most waters which lead to delignification. Suitable corrosion inhibitors should be added to the water to protect metal equipment in accordance with accepted practices.

2) Where halogen, viz. chlorine or bromine, algicides are employed, residuals in the water should not be allowed to exceed 1 to 2 ppm, in order to avoid the oxidizing effect of excess halogen on tower lumber.

3) In most cooling towers some algicide should be used for the proper protection of metal cooling equipment and the towers. At this date, the subcommittee does not wish to make any specific recommendation with regard to preferable algicides, which may be halogens, pentachlorphenol, or quaternary ammonium salts.

4) No recommendation can be made at this date for the elimination of fungus infections, with the exception that infected lumber when discovered should be removed immediately from the tower and replaced with new lumber. It is fully anticipated that the investigations now being conducted by the subcommittee will lead to satisfactory solutions to the fungus infection problem later.

5) General good housekeeping is essential to the proper operation and maintenance of cooling towers. Proper maintenance of cooling towers should include regular periodic inspections, at which time scale and encrusted salt should be removed, water boxes, basins, and screens should be thoroughly cleaned, and all debris and detritus should be removed.

It is believed that if these practices are followed, destruction of cooling tower lumber will be minimized, or, in some cases, even prevented, and that extended trouble free operation of cooling towers will be promoted. As the work of the subcommittee continues, it is the intention of the institute to issue further memoranda from time to time.

RESTAURANT OWNER BOOSTS AIR CONDITIONING

PETER CARAVAS, owner of Regen's restaurant, New York, estimates that air conditioning has increased his business well over 50 percent during the summer months, in the two years since he installed a packaged unit.

"July and August used to be my worst months," he says, "and now they are unquestionably my best. Before this unit was installed, 70 percent of the meals served here during the summer were salads and other cold dishes. Now 80 percent of my summer business is in the hot, higher priced dishes."

The Frozen Air Maintenance and Supply Co. made the installation, according to the Typhoon Air Conditioning Co.

BAKERY BOILER OPERATION DISCUSSED

JOHN W. JAMES, vice president in charge of research, McDonnell & Miller, Inc., listed four factors of particular importance to the operation and maintenance of steam boilers for bakeries, in a talk given at the 28th annual meeting of the American Society of Bakery Engineers. They are combustion efficiency, the scale-forming tendency of the water, maintenance of a uniform water line, and condensate return to the boiler.

Soot on the boiler tube walls is an indication of combustion inefficiency, he said. Flame shape is important to combustion efficiency and when flame impingement occurs, excessive heating of the metal may cause boiler failure. It is important to reduce air leakage through boiler settings to improve combustion efficiency, he stated.

In regard to scale forming tendencies of boiler waters, he pointed out that a systematic procedure for water treatment is most necessary, and boiler water should be tested daily.

Too high a water line in a boiler reduces the amount of steam space and adversely affects steam quality, he stated. Uniformity of steam quality is particularly important in a bakery, he said, because steam is used to produce a glaze on certain products; to facilitate the breaking of cut and split top loaves; and to keep rye bread from bursting.

Dirty water will cause priming, foaming and water line fluctuations — the answer is to clean the boiler. Excessive firing rates also cause water line variations; the answer to this is more boiler capacity.

He then explained methods of maintaining uniform boiler water lines automatically by controlling boiler feed pump operation through float operated devices installed on the boiler and make-up feeder mounted on the condensate tank.

In concluding his discussion, he stressed that returning hot condensate to the boiler is an important method of saving fuel. He showed a few ways of utilizing waste heat by means of condensers and heat exchangers.

SAFER STEPS WITH SNOW MELTING

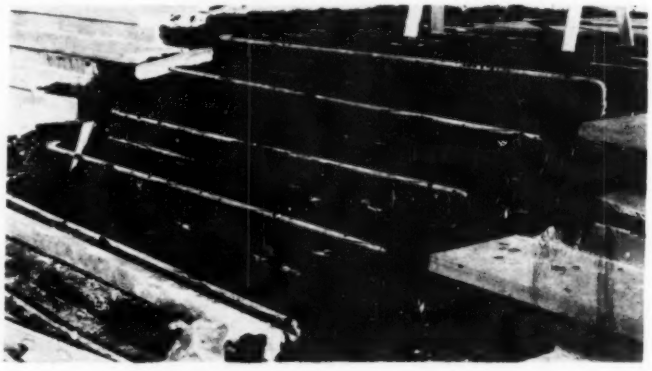
THE ENTRANCE TO a research experiment station has been made safer with snow melting piping.

The approach consists of 14 treads, and two landings each 8 ft square. Flagstone treads and risers had been laid over the original concrete.

The flagstone was removed and the concrete was scored to admit lengths of ¾ in. wrought iron pipe. An undercovering of a heavy mastic waterproofing base preparation was poured, after which the pipes were set in the grooves. Mortar was poured over the pipes to a thickness of 1½ in. When the mortar had dried, the flagstone treads and risers were returned to their original positions.

A solution of hot water and antifreeze is circulated through the piping at a temperature of 160 deg to keep the steps and landings free of snow and ice.

THE FLAGSTONE WAS removed and the concrete scored for the pipes. After the piping was installed, the flagstone was replaced



FLAMINGO APARTMENTS
1220 N. BROAD ST., PHILADELPHIA

Diagrammatic view showing piping arrangement for Webster Tru-Perimeter forced hot water heating. Inset shows basement detail with heat exchangers, pumps and mixing valves for Webster Continuous Flow Controls.

Architect: John H. Graham, A.I.A. Associate Architect: Sweet and Schwartz, A.I.A. General Contractor: Turner Construction Co. Heating Contractor: Benjamin Lessner Co., Inc.

MECHANICAL DESIGN NOTES

Only four risers across entire front of building. Two-zones—one serving floors 2 to 8, the other floors 9 to 15, each with separate Webster CF-2 Control and Outdoor Thermostat. Each zone vented to tank at top of zone — no individual room vents. Two heat exchangers and circulating pumps all interconnected.

Perimeter Heating

For 15-Story Flamingo Apartment Building

Webster Tru-Perimeter Heating with series-connected Webster Walvector and Webster-controlled continuous flow hot water heat provided the designers of this ultra-modern building with comfort heating and attractive interiors without sacrifice of many novel building construction features contributing to low cost. Consider these features:

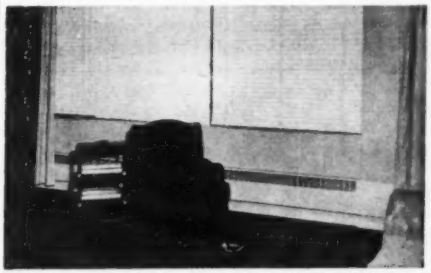
(1) Economy construction. No hung ceiling, no furred columns to conceal piping.

(2) Supply and return risers concealed in partitions at convenient column locations; less than half the risers required in conventional piping.

(3) All connections concealed in continuous Walvector enclosures (see photo), customary runouts completely eliminated.

(4) Neat, attractive, out of the way, matches modern architectural style.

(5) Continuous draft-free, mild heat blanketing the almost all-glass exposure. Water temperature varied automatically with outdoor temperature changes.



Living room in typical apartment showing Webster Walvector.

What is Tru-Perimeter Heating?

Webster Tru-Perimeter Heating uses Webster Walvector, Webster Baseboard, or a combination of both, to replace the heat at the perimeter where heat loss occurs. Heating elements are mounted close to the floor along outside walls, spreading the heat the entire length of the exposed walls.

Webster Tru-Perimeter Heating warms the air within a room, warms the floors and warms the inside surface of outside walls where a normal coolness occurs during winter months. Gently moving warm air is drawn to floor level and across the floor into the inlet opening of the radiation. Radiant heat rays strike the floor along the full length of the exposed wall. Floors are warm and comfortable even with slab floor construction.

Webster Tru-Perimeter results are obtainable with either forced hot water or Moderator controlled low pressure steam heating. For further information about Webster Tru-Perimeter Heating for a new building or modernization see your Webster representative or write us.

Address Dept. HP5

WARREN WEBSTER & COMPANY

Camden 3, N. J. Representatives in Principal U. S. Cities

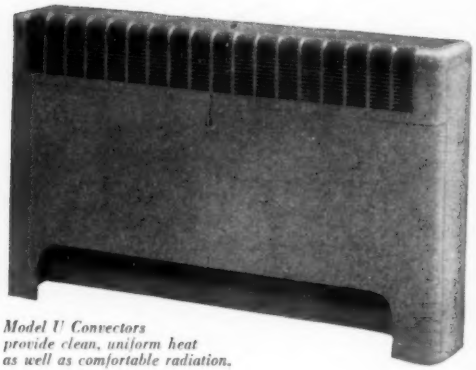
In Canada, Darling Brothers, Limited, Montreal

Webster WALVECTOR

REG. U. S. PAT. OFF.

For Steam or Hot Water Heating

How many of these *advantages* do you get in the *convectors* YOU buy?



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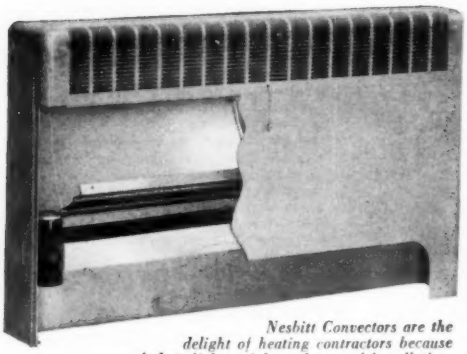

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"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

AIR PANELS FOR HEATING, COOLING

I SHOULD LIKE to answer the comments made by Albert T. Jorn in the April HPAC on my article on air panel heating and cooling for floor or ceiling use, which was published in the March HPAC.

Mr. Jorn feels that "panel response would seem to be very slow". I do not think that Mr. Jorn could possibly be referring to the ceiling type panel with its thin aluminum shell, but must be thinking of the floor panel. An explanation of the floor construction may clarify this point. There is a topping of 2½ in. of concrete over the cellular steel deck which acts as the floor panel. This 2½ in. topping is about one-third the concrete mass used in the standard multi-story slab construction for a coil type system. The comparative "thin-ness" of our slab will obviously decrease the time lag in either a heating or cooling cycle. Another consideration is that the surface of the steel deck floor panel is the same as the concrete top; compare this for heat transfer with ¾ in. or 1 in. diameter pipe placed 9 in. or 12 in. on centers.

The panel systems described in my article are "split" in the sense that air from the panels is brought into the conditioned space. Mr. Jorn recognizes that good control of air temperature can be maintained in such a system. The split system also accounts for the lack of lag in the actual air conditioned space.

I do not wish to engage in a controversy over methods of figuring heat gain and heat loss, but I feel that exchange of energy in a space occurs without regard to the type of heating or cooling system used. Mr. Jorn's statement that the structure absorbs radiant energy which a conventional system does not have to deal with will, if true, apply to all radiant systems.

The combined water and high velocity air system will reduce air handling equipment but at the cost of introducing an entire water system with all the possible complications of a double system—separate controls, additional labor and trade coordinations, etc. Also it may be noted that a high velocity air system increases power consumption due to higher static pressures.

Our approach has been to reduce the amount of ductwork by lowering the amount of air necessary to do the job. This is accomplished by increasing the temperature differential between the room air and the air entering the panel. We can raise the differential to 25 or 30 deg, since the panel acts as a reheat coil and brings the air temperature as it reaches the diffuser to within the comfort range for convection distribution. Control is accomplished with a room thermostat.

We have found this to be the best method of control as the temperature of the air and panel surface will vary with heat gain conditions of the space.

Mr. Jorn's statement that "floor panel cooling is basically unsound unless overcome by some other feature of design" is a qualifying one that eliminates it from our discussion. The introduction of air in our design from ceiling diffusers or wall registers eliminates any chance of the stratification which worries Mr. Jorn.

In closing, I should like to answer the comment that the floor and ceiling panels would not "meet modern architectural standards". We have recently had floor and ceiling panels installed in buildings of 7200 sq ft and 6700 sq ft floor areas respectively. We have had no objections to the panels from any architectural standards. I might add that the equipment rooms were designed for conventional systems and we did not require any greater allowance for air panel systems.— R. P. GOEMANN, Chief of Heating & Ventilating Section, John D. Dillon, Consulting Engineers.

APPLICATIONS OF DUST COLLECTORS

JOHN M. KANE, manager of the dust control division of the American Air Filter Co., discussed the applications and efficiencies of dust collectors at the industrial ventilation conference held recently at Michigan State College.

A summary of the papers and talks given at this conference appeared in the April HPAC, and Mr. Kane's remarks were reported on page 89. He pointed out that the high capacity dust collectors used for industrial applications, where the dust load is in the vicinity of 100 to 500,000 grains of dust per 1000 cu ft of air, should not be confused with ventilation type filters which handle applications having from 1 to 4 grains of dust per 1000 cu ft of air.

Unfortunately, through an error in note-taking, these figures were indicated in the April issue to be "per cu ft" rather than the correct "per 1000 cu ft" of air.—THE EDITOR.

HOW SHALL ENGINEERS BE TRAINED?

REFERENCE WAS MADE in the December issue to graduates from cooperative courses in engineering, and to an address by H. B. Richmond, chairman of the General Radio Co., before the Engineers Council for Professional Development.

I am interested in education and training for engineering and I would be most grateful if you could send

me a copy of Mr. Richmond's address, or any other material describing essentially what is meant by the cooperative system.

Some universities in England have a system in which the student spends part of each year in the works. This is supposed to overcome some of the disadvantages arising from the works apprenticeship system, in which a boy is trained in the works for four or five years, and the university graduate apprenticeship system, in which the graduate spends two years in the works after graduation.

In the apprenticeship system, a boy can learn a great deal of practical engineering and can gain an insight of the engineering craftsman which he can never obtain as a graduate, for the simple reason that the young boy more easily achieves the sympathy and friendliness of the craftsman, whereas the theoretical outlook of the graduate engineer tends to raise a barrier between himself and the craftsman which neither is able to surmount.

The plan by which the student spends part of his time in the works and part in the university looks well on paper, but since each year the student spends his time in a different works, I am inclined to think that he never gets very much out of the works in which he spends his half-year, simply because there is not a strong enough incentive to make the employer take sufficient pains to provide the right sort of experience and training.

An attempt is being made in England to modernize the apprenticeship system by making it obligatory for the student apprentice to spend at least one day and two evenings per week at a technical college for some three or four years, up to the point where the boy takes Part 1 of the final examination for the degree (external) of Bachelor of Science in Engineering in the University of London. The fifth year is spent entirely in college, taking the second part of the final examination at the end of the year. The standard of the examination for the London B.Sc. (external) in engineering is very stiff, and makes a greater demand on the student's knowledge than does the examination he would pass as an internal student, and it is only possible for boys to succeed in this plan who have already taken their Inter B.Sc. before starting the apprenticeship course. (Inter B.Sc. is the examination normally taken at the end of the first year for science and engineering degrees in English universities.)

My own idea would be to reduce the period spent in the works by six months or one year and increase the time spent in college by a corresponding amount, but we shall be able to see this better when the scheme has been in action for a little while.

The claim put forward and reported in your December issue, that the cooperative graduates are a full year ahead of the engineering graduates from conventional courses, seems to me to require rather careful examination, as it depends entirely on the year to which the claim refers.

The graduate from the cooperative system may well be ahead in the first year, but where does he stand in relationship to the conventionally-taught engineer after five or ten years?

My impression is that very few technically trained people are capable of expressing themselves, and that much more time should be devoted in the ordinary university course to make sure that the university graduate will be able to express himself clearly and accurately in his own language. If half the time available for his attendance at the university is to be spent in the works, it would be impossible to find time to give him this very necessary teaching.

To summarize, I believe the ideal arrangements would be:

1) Two to three years works apprenticeship in which the boy learns craftsmanship by day and concentrates on mathematics and physical sciences during one day and two evenings a week, with a third evening devoted to elementary economics, world history, geography, etc. The age range for this period would be 17/18-20, entrance being dependent on passing an examination equivalent to the London Inter B.Sc. for the 18 year old and a near equivalent for the 17 year old.

2) Three years at the university where the student is educated and during which he learns the art and science of applying fundamental considerations to engineering problems.

3) One or two years post graduate education at any other university in a specialized department of engineering—electrical, chemical, mechanical, civil, etc.—in order to build a knowledge of the progress and development in the specialized department on the firm foundation laid during item (2) and provide him with a sense of proportion as well as a certain amount of specialized knowledge of particular value.

Unfortunately, the present system of two years National Service interferes badly with any attempt to devise satisfactory schemes of training and education. Also, craftsmen are rapidly disappearing, and this fact may force us into a revision of the whole picture.

I look forward to hearing other views on this matter. I have no doubt they will be quite different from my own.—L. KING (England).

FRONT COVER PHOTO

CHEMICAL SOLVENTS are stored in a 124,000 gal outdoor tank farm and piped to the new Parke, Davis & Co. chloromycetin plant at Holland, Mich. More than four miles of aluminum tubing — some of which is shown on the front cover — connects the tanks with gages in the plant.

Many of the reactions involved generate considerable heat, and thousands of gallons of cooling water are required. One large room in the plant houses the compressors for refrigeration and ice making, and nearby Lake Macatawa and 40 different deep wells are sources of water.

COMPARATIVE FUEL VALUES CHART

A NUMBER OF requests have been received for extra copies of the chart showing comparative values of fuels based on equivalent heat units, published on page 112 of the April issue.

While obvious from the chart itself, it should have been further indicated in a footnote that the values given are based on net fuel values and that differences of combustion efficiency are not taken into consideration by the chart.

In the fourth line of the chart, the heating value of producer gas was indicated as 100 Btu; this should be 150 Btu.—THE EDITOR.

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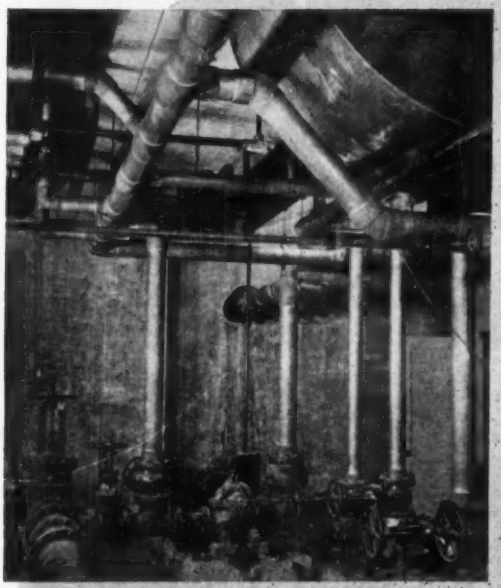

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Revere Copper Tube is non-rusting, has high corrosion resistance, is easily worked, installation costs are no more than for short-lived materials. It is joined with solder or compression fittings. Revere Copper Tube is ideal for replacement as it is readily bent, requires fewer fittings. It is available in hard and soft tempers, in straight lengths; also in 60′ coils in soft temper. Each length is marked with the name Revere. Look for this mark. It assures uniform quality.

To maintain your reputation for top-quality jobs, while metals remain short, use Revere Copper Water Tube wherever you can. The Revere Technical Advisory Service will be glad to help you in every way possible. Avail yourself of this service through your Revere Distributor. Call him today.

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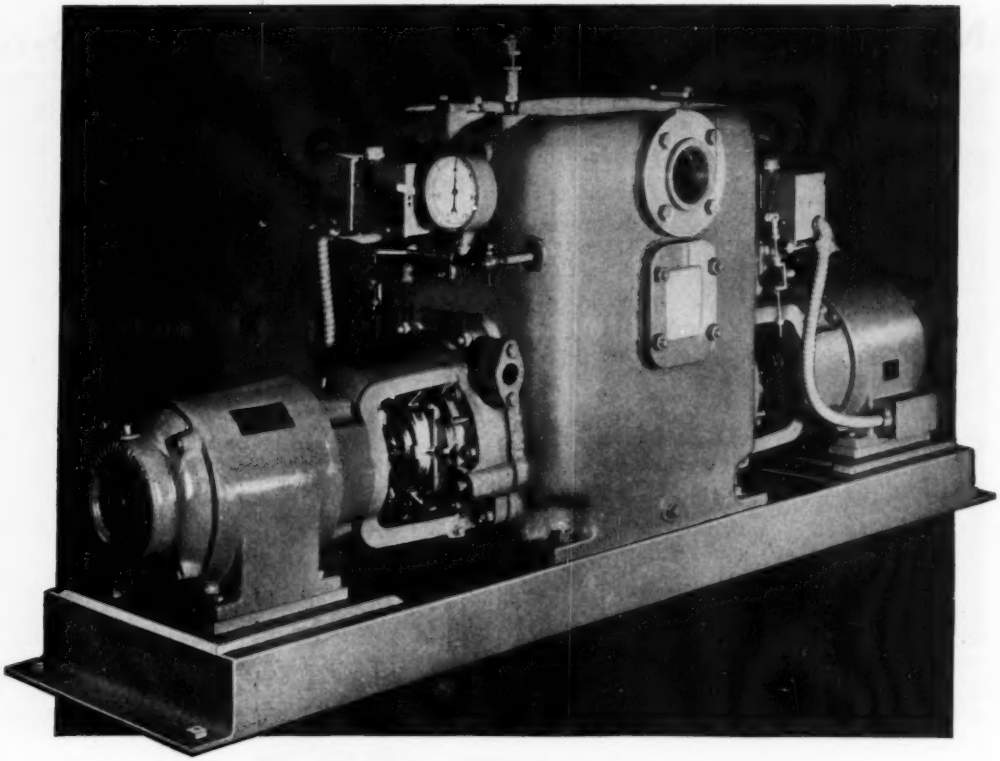

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ONE OF TWO SIMILAR shopping centers where precooled well water is used at the New York Life Insurance Co.'s Fresh Meadows development. A 15 hp compressor in each location can provide cold water for 78 tons of air conditioning

Improving Use of Well Water for Air Conditioning

By A. I. McFarlan
A. I. McFarlan Co., Inc.
Air Conditioning Contractors

The cost of refrigeration is a major item in air conditioning, so that if cold well water is available and is utilized in the proper manner an important saving can be achieved. Certain disadvantages of well water for air conditioning can be overcome by methods described here which have been applied to several shopping center developments and other buildings. . . . . Some interesting points come out in the discussion. For example, it is indicated that the return to the owner of a shopping center on the air conditioning service supplied the tenants can be greater than returns from space

WHERE WELL WATER is economically available, it is possible to take advantage of its low temperature to save both first cost and operating expense in air conditioning systems.

Well water has generally been used by one of the following methods:

1) For the condenser of a mechanical refrigeration system.

2) For cooling air directly, either by a spray or coil.

3) For air precooling, supplemented by direct expansion to further cool the air.

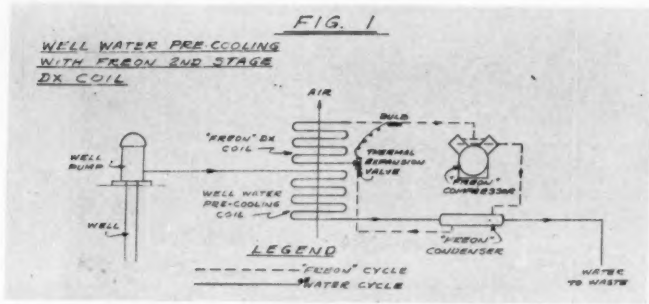
4) For air precooling, supplemented by chilled water second stage cooling of the air.

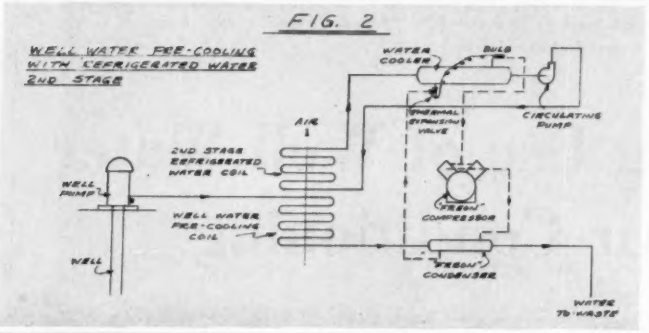
A disadvantage of well water not to be overlooked results from its temporary hardness, which may be deposited in a condenser at a condensing temperature above 100 F.

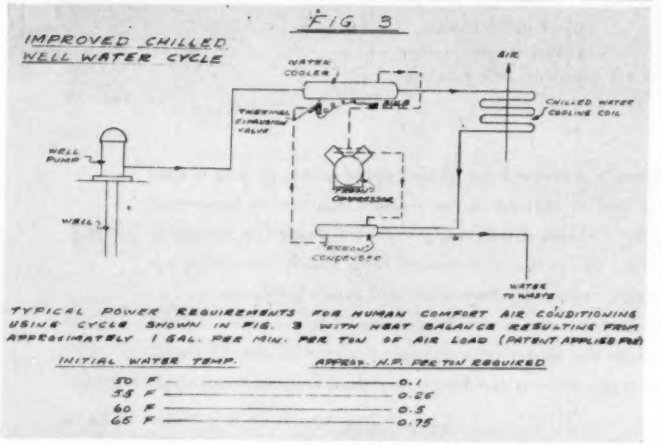
Sometimes the use of hard water for make-up in evaporative condensers produces a deposit on the coils and casing, resulting in corrosion and marked reduction in heat transfer. This problem prompted the study which resulted in the precooled well water system described in this article.

Limitations on Well Water Use

Wherever well water is used in any form, there is the possibility of reducing the water table. Many states or other areas have enacted







TYPICAL POWER REQUIREMENTS FOR HUMAN COMFORT AIR CONDITIONING USING CYCLE SHOWN IN FIG. 3 WITH HEAT BALANCE RESULTING FROM APPROXIMATELY 1 GAL. PER MIN. PER TON OF AIR LOAD (PATENT APPLIED FOR)

INITIAL WATER TEMP.	APPROX. H.P. PER TON REQUIRED
50 F	0.1
55 F	0.26
60 F	0.5
65 F	0.75

legislation limiting the quantity of water that can be removed. Sewer taxes have been imposed which establish a cost in proportion to the quantity of water discharged. It is always desirable to use a minimum of water, if for no other reason than to limit the depletion of a natural resource.

While many users of well water object to such restrictions, they are generally in the interests of each user—for the ultimate result is to reduce the amount of well water used in a system. One of the features of the system described here is that the quantity of well water required is reduced to a minimum.

The use of conventional all-well-water cooling for air conditioning is limited to areas where the well water is continuously available at a temperature below 55 F, and preferably below 52 F, in quantities of at least 3 gpm per ton of air conditioning and preferably 5 gpm per ton. This results in only a 5 to 8 F rise in temperature of the water, after which it is returned to the ground or wasted.

In some instances where adequate well water is available with little possibility of future restrictions, it has been used without refrigeration in one form or another. The disadvantage in such cases is inadequate moisture-removing ability at partial load.

Most air conditioning systems are designed for an inside temperature of 80 F and 50 percent relative humidity, which for a peak outside condition (generally 95 F) is a 60 deg dew point. While this inside condition has been accepted as a standard for guaranteed performance and is the basis of the American Society of Heating and Ventilating Engineers' requirements for human comfort, it is nevertheless inadequate for outside temperatures substantially below 95 F. In many localities, temperatures as high as 95 are infrequent, and the average summer conditions are usually from 75 to 80—frequently with wet bulb temperatures of 70 to 75 F. With this condition, an inside temperature of 75 F is desirable. The conventional all-well-water system, which at best is pressed to obtain a 60 F dew point leaving the coils, produces a most unsatisfactory relative humidity for increased wet bulb outdoor air and inside dry bulb conditions of 75 F or lower.

As indicated above, it is desirable to have a coil temperature that will result from water not higher than 52 (although 55 F is sometimes permissible). But even a slight rise above 55 F well water greatly aggravates the resulting inside moisture condition even in the best all-well-water systems.

For theater and other applications having heavy internal latent loads, it is frequently impossible to obtain a satisfactory humidity condition in the conventional all-well-water system even for peak outside dry bulbs.

Layouts of Typical Systems

Fig. 1 shows a typical conventional system using well water for air precooling, with a second stage direct expansion refrigeration system.

Fig. 2 shows a similar system, except that the direct expansion second stage is replaced by a chilled water system.

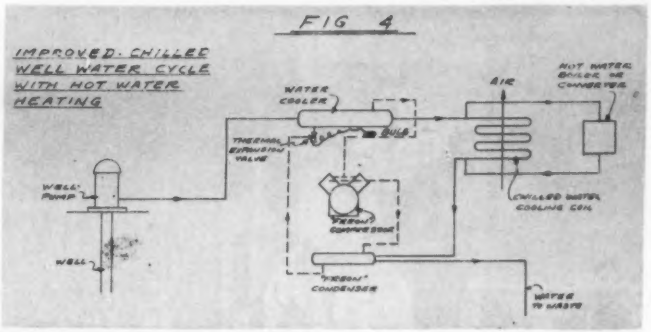
Examination of these cycles shows that a slight rise in the water temperature causes a major shift in the

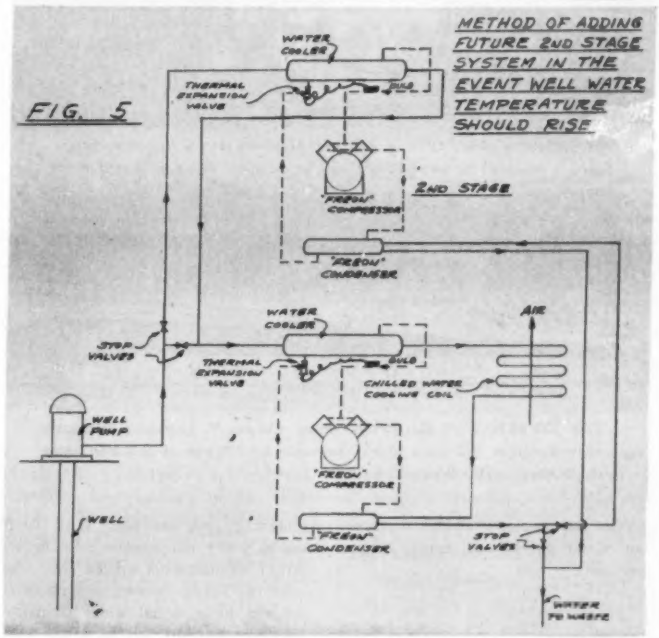
load from the precooling coil to the second stage cooling system. Before a system such as either of these is installed, it is important to consider the effect of a future rise in well water temperature, especially in those areas (such as Long Island) where well water must be returned to the ground through diffusion wells. Such a rise in temperature, which has not been planned for, causes the second stage to become too small because the first stage no longer carries an adequate share of the load.

A correction involves changing or adding to the elements—that is, coils within the air stream, additional compressors, condensers, refrigerant lines, etc. If the system involves water cooling, as shown in Fig. 2, the water cooler, pumps, etc. must likewise be replaced or added to so as to provide increased capacity. Such corrections may involve shutting down the system for a long period of time while the changes are being made. Changing refrigerant or cold water lines running through the building may require extensive alterations and redecorating, which are expensive, and also interferes with the normal work within the conditioned space, or even its occupancy.

Thus, the limitations of a well water system which precools air directly are such that the offsetting economy is often not warranted.

For differentiating in this article, where well water is used to precool the air before a second stage of another type of cooling, the system is referred to as an air precooling system. Where the well water itself is cooled, the reference is to a precooled well water system.





An Improved Precooled Well Water System

Extensive research has been carried out by the author's company, resulting in an improved precooled well water system, on which patent protection is being sought. In this system the quantity of well water is reduced to an economic minimum.

In general, approximately 1 gpm per ton is the most advantageous quantity to use, although the system is adaptable to operate with less water—especially where large quantities of outdoor air at high dry bulb temperatures are required at peak load.

Each system is designed to require a certain amount of water so as to give a particular optimum heat balance depending upon local factors, including:

1) Cost and output of well or wells.

2) Initial water temperature.

3) Probable future rise in well water temperature.

4) Nature of air conditioning or refrigeration load.

5) Relative first cost of refrigerating equipment, heat exchange apparatus, coils, etc.

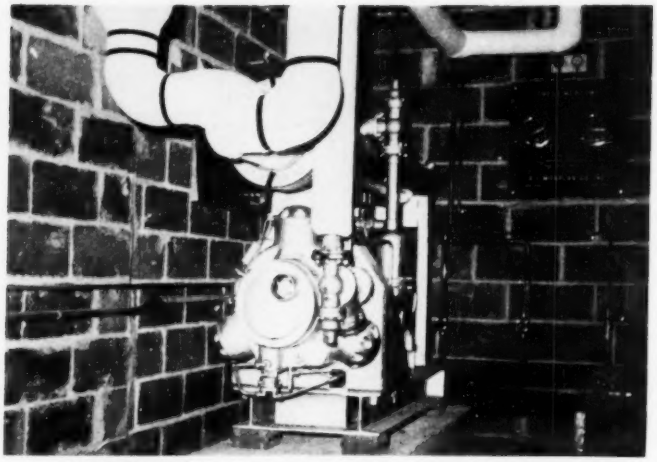
6) Savings in operating cost possible with higher first cost.

It is obvious from an examination of Fig. 3 that the higher the water range across the air cooling coil (the greater the rise in water temperature), the less well water is required.

The less well water that is required for a constant temperature entering the coil, the smaller the refrigeration plant.

Accordingly, the air cooling coils are longer circuited, and have relatively greater depth in the path of air flow than is conventional practice.

With well water precooling systems, the compressor size no longer is a function of the air tonnage but rather is entirely determined by the capacity required to cool the water sufficiently to obtain the proper dehumidification. While the compressor horsepower will vary on different types of installations, an analysis of typical human comfort requirements similar to office use shows horse-



A COMPRESSOR AT ONE of the Fresh Meadows remote shopping centers. Space is provided for an additional unit in the event of a rise in well water temperature

THE STYERTOWNE SHOPPING center, Clifton, N. J., now in the course of construction, will use a 30 hp compressor for 250 tons of air conditioning in 26 stores and a floor of offices

power requirements at the compressor about as follows, using 1 gpm per ton:

52°	water—1/10 hp	per	ton
55°	water—1/4 hp	per	ton
60°	water—1/2 hp	per	ton
65°	water—3/4 hp	per	ton

Improved Operation At Partial Load

With well water precooling as shown in Fig. 3, the system permits a reduced water quantity and a lower final water temperature for partial load, at which time excess compressor capacity is available. This in turn permits increased dehumidification which is so necessary for reduced inside dry bulb operation at partial load.

By means of a simple control, it is possible to assure desired humidities at partial load in a way that is difficult to match in the types of systems shown in Figs. 1 and 2.

It is obvious from the above that well water at higher temperatures can be used at the rate of approximately 1 gpm per ton. With 70 F initial water temperature, the horsepower requirements will be about the same as for a conventional system. Such a high initial water temperature can be justified in areas with continuously high wet bulbs and cheap wells—also where the water temperature will be lower for part of the year, as is sometimes the case with surface water.

In general however, about 65 F is the initial temperature at which this scheme becomes attractive. Below 65 F well water temperature, the saving in first cost and operating expense will increase as the well water temperature decreases. For 50 to 55 F well water, 95 F dry bulb and 75 F or higher wet bulb outside conditions, the operating cost will be substantially lower than for a full compression system, and frequently lower than for a conventional all-well-water system.

For average well costs, the first cost of the system will almost always be lower than a conventional compression system, and sometimes lower than a conventional all-well-water system. In addition, the well water precooling permits operation at humidity conditions which are impossible with a conventional all-well-water system at reduced loads (as explained above.)

Provision for Future Well Water Temperature Rise

A ready solution is available to compensate for increased well water temperatures, should this contingency occur. It is only necessary to install a separate water cooling system to reduce the well water from the higher temperature to the original design temperature. Diagramatically, this additional refrigeration is shown in Fig. 5.

Where well water is available at 55 F, the chances are very slight that a future rise to above 65 F may occur, even with water returned to the ground through diffusion wells. Even after provision is made for a rise to as high as 65 F, operating expense will be about 25 percent lower than with a conventional system.

A conventional cold water circulating system with several air cooling units—as frequently used in department stores, office buildings, industrial plants, etc.—involves an average of 2 gpm per ton circulated through the lines. With 1 gpm per ton or less, the sizes of the pumps and the lines can be reduced. This can represent a substantial saving where lines are long, especially considering that those lines must be insulated and often present problems with respect to covering and hiding them.

Also, one well pump can serve for the cold water circulation and condensing, replacing a cold water pump and condensing water pump—both of which must be larger than the single pump.

Combining the Heating and Cooling

Where the heating facilities can be combined with the air conditioning—as is possible in a new project—the advantages of small lines and long coil circuits can advantageously affect the first cost of the heating system. Generally, where the same coils are used for cooling, too much

water is circulated in the heating season. With a smaller water quantity circulated and deeper long circuiting coils the use of hot water heating is permitted where otherwise it might be uneconomical.

Our experience has shown that in areas where the outside temperatures reach 0 F and supplementary radiation under windows is required, the first cost of a combined air conditioning and heating system using well water precooling and hot water heating is quite economical.

Industrial and Shopping Center Applications

The well water precooling system is particularly adaptable to industrial plants in suburban locations where wells are more readily available. The reduced first cost and operating expense using the well water precooling system frequently make air conditioning possible, when the cost of a system might not otherwise be as easily justified.

The author's company has installed a precooled well water system for the Ortho Pharmaceutical Corp. at Raritan, N. J. This installation handles 88 tons of human comfort air conditioning in offices and 20 tons in a cafeteria, or a total of 108 tons, with 90 gpm of 60 F well water. Under this condition, the refrigeration equipment develops approximately 55 horsepower for peak operating conditions and normally cycles between 25 and 50 percent of capacity for average summer operation.

On large shopping centers, a central heating and precooled well water system can be installed by the owner, charging tenants for either cold water alone or for the complete cooling and heating. In the former case, the tenant would then install his own air handling system; in the latter case, the complete air conditioning system would be furnished by the owner.

In either case, the charge to the tenants can be approximately the operating and depreciation cost of a comparable individually owned system. In the former case, the cold water supply would of course eliminate the individual tenants' compressors, condensers, cooling towers or evaporative condensers.

Two shopping centers, installed by the author's company, have been satisfactorily performing at the New York Life Insurance Co.'s Fresh Meadows development in Flushing, L. I. These shopping centers are similar in size.

LEVY BROTHERS department store, at Styertowne, will use 25 hp of refrigeration for 105 tons of air conditioning

THE INSTALLATION BY the author's company at the Ortho Pharmaceutical Corp., Raritan, N. J., handles 108 tons of air conditioning using 90 gpm of 60 deg water with approximately 55 bhp at the compressor for full load, and frequently cycles at 25 percent and 50 percent for partial load. When it is possible, the well water carries the load without the compressor operating

The capacity with all stores air conditioned is 78 tons for each shopping center. Using 54 F well water, this load of 78 tons can be handled with a 15 hp compressor. Provision for a future 15 hp compressor in each center will permit a rise in well water temperature to 60 F, should this contingency occur.

The same system is now being installed for the new Levy Brothers department store and Styertowne shopping center in Clifton, N. J.

The shopping center consists of 26 stores in addition to the three-story department store, and has a floor of offices above the 26 stores. The total capacity is approximately 350 tons, and will be handled with approximately 55 compressor hp and a 30 hp well pump, with an initial well water temperature of 52 F. In both the department store and shopping center, a hot water boiler is used to supply hot water for heating through the same pipes and coils used for summer cooling.

The Economics of the Application

The economies of a combined well water cooling and hot water heating system can readily be illustrated by its application to shopping centers. Where the well cost is average, and the capacity in excess of 100 tons, the breakdown of costs and tenant payments for air conditioning can be about as follows:

Using a cost per ton that would be average for each tenant had he put in his own system, our experience has been that the rental charge for complete air conditioning furnished by the owner will be an amount approximately equal to the interest on the investment, depreciation and power cost. This will average $35 to $50 per ton per year.

With the above charges to the tenant, the return on the air conditioning system to the owner can be

as great if not greater than on the shopping center itself. The average cost of such a system to the owner, including the well and boiler, is approximately $850 per ton.

There is a trend today to reduce capital expense wherever possible. Air conditioning on a lease basis permits this feature and can often result in a very attractive tax saving.

Well Water as a Thermal Flywheel

Where large quantities of well water are used for air conditioning and then returned to the ground in the summer, the temperature in the area tends to rise. While there have been relatively few so called "reversed cycle" installations to date, it seems reasonable to assume that the well water cooled in winter in many such installations would tend to lower the well water temperature during the winter.

As reversed cycle installations become more prevalent, as they no doubt will in future years, the rise in temperature during the summer may become a means of storing large quantities of heat in the ground, to become usable the following winter. Reduction of the well water temperature during the heating season would then produce a source of further potential refrigeration for the following summer.

While such a "thermal flywheel" may seem fantastic at the present time, several years from now the possibilities may be much more apparent. This would be an ideal method of preventing changes in the level of the water table, as well as solving the problem of removing large quantities of water from the ground, which may become an increasingly severe problem in the future.

How To Insulate Steam Tracer Piping

MANY ENGINEERS AND contractors have found that blanket type mineral wool solves such troublesome installation problems as the insulation of asphalt pipe lines heated by spirally wrapped steam tracers, says the Industrial Mineral Wool Institute. Coiled around large diameter asphalt piping, the steam lines provide sufficient heat to maintain the asphalt at the fluidity required for proper pumping and handling.

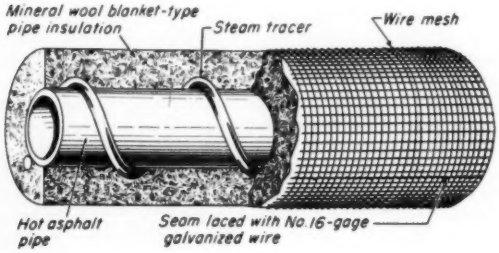
Blanket type pipe insulation is flexible and compressible enough for installation over the irregular contours of pipe lines heated in this manner. Easy application, good appearance and effective insulating performance are the results.

To insulate the spirally traced pipe shown in the sketch, each section of blanket type mineral wool pipe insulation is roughly shaped to fit over the asphalt pipe and tracer. The edges of all sections are tightly laced together with 16 ga galvanized wire. The longitudinal seams are located on the underside of the pipe. Exposed ends of the lacing wire are bent over into the insulation to eliminate sharp projections.

Available in 2 ft lengths, the mineral wool blanket sections are commonly provided with reinforcing metal lath or wire mesh on one or both sides. In the sketch, the insulation is secured with wire mesh on the outside and expanded metal lath on the inner surface. The metal lath is applied to the insulation in parallel strips to provide additional flexibility.

Asphalt piping located indoors may be finished with two ¼ in. thick coats of mineral wool insulating cement. The first coat should be allowed to dry thoroughly before the second coat is applied. As a finish, asphalt saturated roofing felt, with seams lapped at least 2 in., is wired or banded in place on about 6 in. centers. Asphaltic finishes and canvas jackets, both applied over insulating cement, are also often specified. In outdoor locations piping may be finished with either roofing felt, asphalt weatherproofing, or a sheet metal jacket. It is important that both roofing felt and sheet metal jackets be lapped downward.

SPIRALLY TRACED ASPHALT piping may be insulated effectively in this manner



REPORTS ON HANDLING RADIOACTIVE MATERIALS

MAJOR ACTIVITIES of the Atomic Energy Commission are reviewed in the AEC's 11th semi-annual report, a publication of some 200 pages.

One of the studies discussed briefly is the work at Johns Hopkins on the adsorption of radioactivity by metals used in piping systems. It has been found, says the report, that alloys containing lead and copper are much more susceptible to contamination by iodine 131 than galvanized iron or stainless steel. The information is believed to be useful in connection with the design of drainage systems for laboratories using radioactive materials.

A group at Harvard University has brought nearly to completion a testing program to evaluate commercial air cleaning equipment in the light of AEC requirements and has completed a Handbook of Air Cleaning, which is to be published.

Other investigations are in progress by A. D. Little, Inc., Cambridge, Mass., on a new high temperature, acid resistant air filter; by New York University on the feasibility of reproducing certain atmospheric phenomena in a wind tunnel; and by the University of Illinois on aerosols.

Piping Code's Fuel Gas Requirements Being Published Separately

The requirements of the American Standard Code for Pressure Piping pertaining to the transportation and distribution of fuel gas are to appear in a separate section complete in itself, without the necessity for cross referencing to other code sections . . . . . Steps are being taken to broaden the membership of the new subcommittee involved

AT THE ANNUAL MEETING of the American Standards Association sectional committee B-31, which is responsible for the American Standard Code for Pressure Piping, it was agreed to undertake the publishing of requirements for the transportation and distribution of fuel gas in a separate section complete in itself without the necessity for cross referencing to other sections.

At the same meeting, the committee directed the officers to take recognition of the present significant position of the gas industry, which embraces both high-pressure transcontinental transportation lines and low-pressure distribution systems. These two phases involve separate and distinct problems. It was decided, therefore, to create a new subcommittee for segregating the requirements for fuel gas transportation and distribution systems in a separate publication of the code, leaving those for all other gas and air piping where they are in the main body of the code. This is an important step in the development of national safety codes and properly reflects the position of the gas industry in the American economy.

The sectional committee officers report that the work of consolidating the gas section into a single integrated document is making good progress. In the meantime, steps are being taken to broaden the membership of the new subcommittee on transportation and distribution piping. The officers report, too, that all phases of industry have enthusiastically responded and that the membership of the new subcommittee will include men of proved competence and with broad working knowledge and experience. In addition, it has been possible to get representation from all sections of the country. This augurs well for the high degree of industry responsibility for public safety that has become synonomous with the American Standards Association approach to safety code work.

A Careful and Critical Examination

The officers report that the first assignment of this new subcommittee will be a careful and critical examination of the scope of the present gas and air section to determine the extent to which it should be enlarged or expanded to reflect experience and the requirements of public safety. This will then be followed by the usual procedures for the development of the necessary code requirements, which work will be paralleled by critical review and improvement in the existing provisions.

F. S. G. Williams, general chairman of ASA sectional committee B-31, has called attention to the fact that national codes for safe construction are never static — that they require constant, thoughtful attention to keep the code abreast of modern developments in design and construction. He further has commented that America could well be proud of the responsibility that has been consistently evidenced by American industry through its active support of codes of safe construction in the interests of public safety, and the work that is currently underway is a concrete demonstration that private industry can and does accept this responsibility.

HOW TO CLEAN A DIRTY GAGE GLASS

IF YOU'VE EVER TRIED to clean a gage glass on a boiler only to wind up breaking it, you'll be interested in this foolproof method, says Vern Polly, of the Minneapolis-Honeywell Regulator Co.

First, get up some steam pressure in the boiler (at least ½ lb). Make up a cleaner solution by mixing trisodium phosphate and hot water in a tumbler. Then close both water and gage valves at the top and bottom of the dirty gage glass. Open the petcock below the gage glass and submerge the petcock in the tumbler containing the cleaning solution. Now, open the top water valve slowly. The steam pressure will drive the water out of the gage glass down into the cleaner. Slowly close the top valve. A vacuum will be formed at once in the gage glass and it will draw the cleaning solution up into the glass. Keep opening and closing the top valve, slowly and slightly, and you will alternately blow steam through the gage glass and fill it with the cleaning fluid.

After you've finished, leave the valves as you found them — the petcock must be closed, the two gage glass valves must be open. Be sure you don't leave the gage glass turned off, Mr. Polly warns.

Heating a First Consideration When University Expands

By W. M. Petry, Associate Professor of Mechanical Engineering, and Robert W. Paul, Heating Engineer, The University of Akron

One of the first considerations in the University of Akron's expansion program was the heating of the new buildings, for the old central plant was not only obsolete but overloaded. The features of the new plant — and some of the results achieved during its first four years of operation — are given here

DURING WORLD WAR II, the board of directors and administrative officers of the University of Akron made a survey of anticipated future enrollment and existing university facilities which resulted in the inauguration of a long range expansion program to increase the building facilities of the university approximately 200 percent. To date, the program has been executed to the extent that building space has been increased 80 percent, with additional construction still in progress.

Heating a First Consideration

One of the first considerations of this program was the heating of these new buildings, for the old central heating plant was not only obsolete but overloaded. The original central heating plant was built in 1900 at a cost of $10,591 and contained two 66 in. by 16 ft HRT boilers with downdraft grates. This plant was enlarged in 1917 and the original boilers replaced with two 72 in. by 16 ft HRT boilers rated at 125 hp and one new 66 in. by 16 ft HRT boiler, all hand fired and operating at 150 psi. Later, a single retort underfeed stoker was installed under one of the 72 in. boilers. In this plant, there was storage capacity for only about 30 tons of coal and room for only a few days' run of ash.

This was the condition of the heating plant in 1943 when plans for the expansion program were progressing rapidly. It was therefore obvious that something would have to be done about the heating system before any new buildings could be added. The university is located too far from the center of the city to purchase heating steam, and the existing heating plant building was entirely inadequate for new boilers and reasonable coal storage. Therefore, it was decided to build an entirely new plant and the project was turned over to William Boyd Huff, architect, and P. B. Fleming, consulting engineer, under the guidance of the mechanical engineering department of the university and several representatives of local industries.

Ground was broken for the new building in October 1945, and boiler erection was started in June 1946. The plant was completed in August '47 and drying-out fires were started in the boilers in September, with the plant going into operation at the beginning of the heating season of that year. Shortly after, the old boilers were dismantled and the building converted to maintenance shops.

The exterior of the new building is of red face brick and is designed to blend harmoniously with the rest of the campus. It is 54 ft by 70 ft by 62 ft over the bunker loft, and the main boiler room is 39 ft by 62 ft with a 26 ft, 4 in. ceiling height, being finished inside with glazed buff tile. The radial brick stack is 6 ft, 6 in. ID at the top and 150 ft high. Included in the building is a shower room, superintendent's office, small shop, material storage rooms, transformer vault and switchroom for the electrical services to the entire campus.

Incinerator Is Underground Outside Heating Plant

The heating plant building is 20 ft from the street, and the boiler room floor is at street level. The ground line rises 11 ft from front to rear of the building, and this rise is taken advantage of by locating an underground incinerator just outside the rear building wall alongside the stack. This location allows the incinerator to be fired, cleaned, etc., by the boiler operators through doors opening into the boiler room, whereas it is charged from outside the building — a most convenient arrangement. The incinerator is drafted through the heating plant

stack, thus discharging the gases at a height at which they are not objectionable. It is also served by the vacuum ash removal system used in the boiler room.

Coal and Ash Storage Inside the Building

Because the university is located in a rather compact residential district and has a small campus, it is necessary that all coal and ash storage be inside the building. Storage space for 300 tons of coal is provided in two reinforced concrete bunkers each 16 ft, 0 in. by 13 ft. 7 in. and 47 ft, 3 in. deep. These bunkers are set side by side and run the full height of the front of the building. Coal is delivered by truck and is dumped into a floor level, 5 ton receiving hopper located in a dust-tight room in the front of the building.

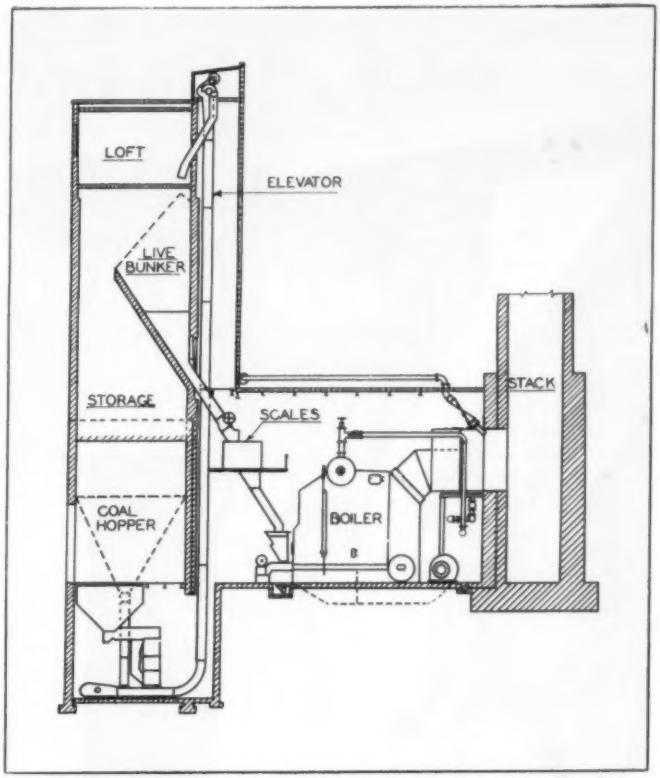
Coal feeds out of the bottom of this receiving hopper onto a reciprocating plate feeder, where it may be discharged either directly into the elevator or through a crusher into the elevator. This elevator is of the bulk flow type; that is, it does not directly transport the coal in buckets but causes it to flow through a rectangular tube by passing U-shaped flights upward through the coal filled tube. This is rather a popular method of moving grains and other light, nonabrasive bulk material but has only recently been applied, to any great extent, to the movement of coal.

This elevator has been in use for some four years and has given entirely satisfactory service. The bulk flow elevator has three decided advantages: Bends may be put in it, it can easily be made dust-tight, and it can be made to occupy a small space. In this case, both the up and down chains are in a single, two compartment steel tube 10 in. by 12½ in. All elevator controls — including bunker selection — are from the boiler room floor.

Gravity Coal Feed To Stoker Hoppers

To provide gravity coal feed into the stoker hoppers, automatic coal scales, one for each boiler, are located on a grating balcony 14 ft, 6 in. above the boiler room floor. Since the bunkers run from the top of the building to the basement (thereby providing a maximum of storage space) it was necessary to provide a live bunker of 25 tons capacity with its outlet 12 ft above the scale floor. This live bunker is simply a reinforced slab set at 55 deg and extending into one of the storage bunkers.

Coal from the elevator discharges onto the live bunker until it is filled and then spills over into the storage bunker. Both of the storage bunkers discharge back into the elevator feeder, and, to replenish the live bunker, the elevator carries coal from storage back up to the live bunker — all of which results in additional elevator operation but makes use of the full building height for coal storage.



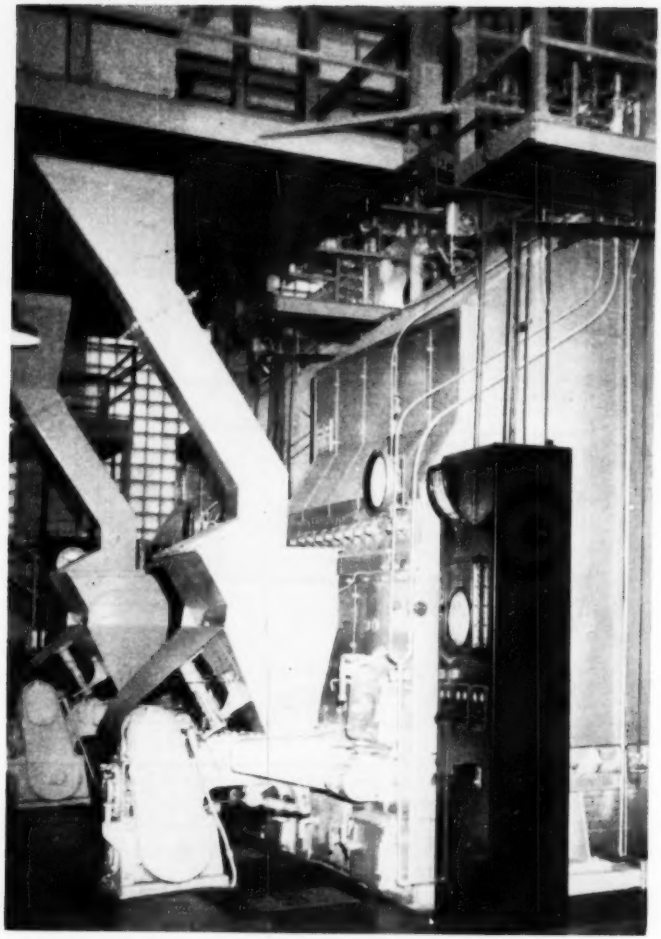
GROUND LINE RISES 11 ft from front to rear of building, which allowed installation of an underground incinerator just outside the rear building wall alongside the stack. It is fired and cleaned conveniently by the boiler operators through doors opening into the boiler room, and is charged from outside the building

Ash Handled by Vacuum System

Ash is handled by a vacuum system consisting of special cast iron pipe laid in trenches in the boiler room floor, the vacuum being created by a steam ejector which discharges into the stack. This system carries the ash up over the boiler room roof to a centrifugal separator located above a 1300 cu ft overhead ash hopper in the front of the building.

As in the case of the coal bunkers, to prevent the ash hopper from distracting from the building's architectural beauty, this hopper is completely within the exterior walls. A door is provided in the front of the building so that trucks may drive directly under the ash hopper, and the room under the ash hopper is separated from the boiler room by a second door, which protects the boiler room from dust created when ash is loaded and also provides direct truck access to the boiler room floor for handling heavy equipment.

A chain hoist is suspended on a



THE STOKERS AND CONTROL boards are shown in this view. Gratings in the floor connect to the vacuum ash disposal system

track from the ceiling to facilitate unloading of heavy equipment or placing electrical transformers in the transformer vault, which is located above the switchroom and shop in one side of the building.

Underfeed Stokers Fire the Boilers

The boiler room has no excavation under it and contains two identical boilers of the integral furnace type with space for another of the same type but double the capacity of the present units. These boilers operate at 155 psi and are rated at 14,000 lb per hr. They are of the two drum, water cooled furnace type, each having a total of 2843 sq ft of heating surface and 415 cu ft of combustion space. Furnace walls consist of 2½ in. tubes on 7½ in. centers, 3 in. thick tile and 4 in. of high temperature block insulation, with all the boiler walls covered by a metal casing.

Fuel is fired by single retort underfeed stokers having hydraulically operated, constant length stroke rams. The continuous fuel feed range is from 50 to 2100 lb per hr of coal, and the stokers may be controlled either manually or automatically. Combustion air for each boiler is supplied by a motor driven fan rated at 6800 cfm at 4 in. static pressure, and air delivery is controlled by a vortex vane type inlet damper. Each fan is located at the rear of its boiler and discharges into the stoker windbox through a steel duct running under the boiler.

Steam Distributed at 65 Psi Pressure

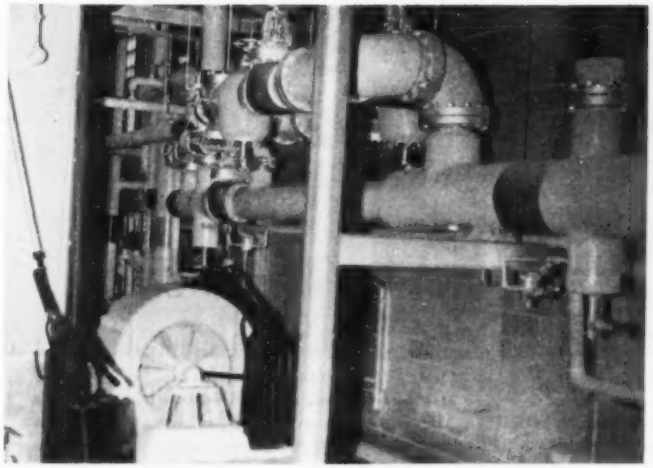
Steam pressure is reduced to 65 psi by a dual automatic pressure reducing station just behind the boiler, and is distributed by means of walk-through tunnels to the various buildings. A distribution pressure of 65 psi was chosen so that steam as it comes to the buildings could be used directly for heating presses, mills, etc., in the rubber research laboratory. A direct line supplies the mechanical engineering laboratories with steam at boiler pressure.

Condensate is pumped back from the various buildings to a collector tank and hence to the deaerator, where it is heated to 220 F by exhaust steam from the boiler feed pumps. This exhaust steam is automatically supplemented by live steam as required to maintain the desired feedwater temperature. The deaerator is set directly above a 2000 gal storage tank. Both are in a heater room in the upper part of the building above the feed pumps and are accessible from the coal scale balcony. Boiler feed is normally by a direct acting steam pump with an electric driven centrifugal pump as standby. Make-up is treated by the zeolite process and fed automatically to the deaerator as required.

How Boilers Are Controlled

Boiler control is by a pneumatic two-element control system functioning from boiler pressure and steam flow, and automatically regulates stoker speed, air delivery and uptake damper position. Automatic water level control is also employed. Each boiler is equipped with a meter and control board, which has the following meters installed on it: Recording meter for steam flow, flue gas temperature and gas flow; integrating steam flow meter; and three pointer draft indicator showing uptake draft, windbox pressure and furnace draft.

The steam pressure gages are on the boiler front beside the boiler board, and the water columns are directly above the board. The boiler



THE STEAM PRESSURE REDUCING station and the forced draft fans are at the back of the boilers under the breeching

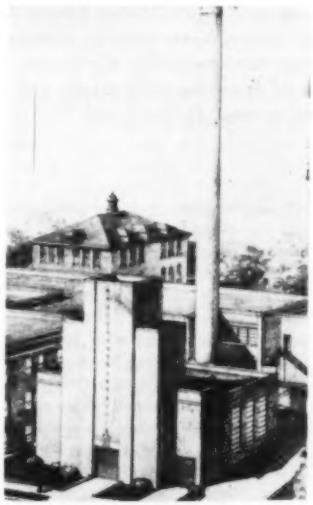
control boards also contain a master boiler control station, fan control station, stoker control station and pushbuttons for stopping and starting the fan and operating the ash disposal system. All other electrical controls are mounted on the building wall opposite the boilers and on the firing aisle. At one end of the firing aisle is a master board, which contains a master control station for all boilers, a clock, a boiler pressure recorder, the header pressure gage and a temperature recorder showing feedwater temperature and temperature in the deaerator.

Operating Results Entirely Satisfactory

Based on over four years of operating experience, the general performance has been entirely satisfactory. Present evaporation averages 10.3 lb of water per lb of coal, the coal having a dry analysis of ash, 7.04; volatile, 40.48; fixed carbon, 52.48; sulphur, 2.3, and a heating value of 13,673 Btu per lb. In fact, since 1947, the heating load has increased from approximately 3 million lb per month to 5½ million lb, and coal consumption is up only about one-third above that of the old plant.

The above evaporation corresponds to a boiler efficiency of slightly less than 76 percent, a figure which has also been checked by boiler tests. This efficiency is particularly good because the boilers have been intentionally operated with more than necessary excess air to guarantee practically no smoke. The absence of smoke is of singular importance, because the city of Akron is conducting an intensive smoke elimination campaign, and, in such a campaign, it is highly advisable that the city institutions lead the way.

Condensate recovery runs approximately 95 percent, and because of this small make-up requirement, the use of a sodium zeolite softener and deaerator have provided adequate treatment for prevention of scale and corrosion in the boilers. Raw water is obtained from city mains and has a hardness of approximately 11.5 grains per gal with a pH of 8.2 to 9.5. This raw water is treated in a 10,000 gal capacity sodium zeolite softener, and the effluent has an average hardness of 0.45 grains per gal. Daily checks are made on the feedwater for dissolved oxygen and on the boiler water for P-alkalinity, M-alkalinity, chlorides, hardness and pH. Boiler blowdown is regulated to maintain an alkalinity of approximately 200 ppm. No internal treatment is used, and to date the only internal cleaning that has been found necessary is yearly washing with high pressure water.



THE PLANT IS ARCHITECTURALLY acceptable on a residential street, as there are no exterior bunkers, silos, piping, etc.

Repair Requirements a Minimum

Since starting operation, repair requirements have been at a minimum, and only a few alterations have been necessary. The original stoker drive between the motor and hydraulic pumps consisted of a chain and sprockets, and, during the first few months, the sprockets showed signs of rapid deterioration. This condition was chiefly due to the fact that, with the chain guard supplied, it was impossible to maintain proper lubrication and to keep dust out of the chain. For these reasons, the chain drives were replaced with V-belts, which have operated satisfactorily to date.

Also, the pneumatic control system was furnished with an 11.5 cfm air compressor, which had to run almost continuously to supply the system requirements. Therefore, during the summer of 1950, an additional 23 cfm compressor was installed to carry the load, and the original one retained for standby use.

During the first months of operation, the coal conveyor drive gears showed evidence of rapid wear, which was found to be due to incorrect alignment during installation. Upon correction of this condition, the conveyor has performed satisfactorily with practically dustproof operation. The ash conveyor has been in operation over four years and has required no attention except minor maintenance.

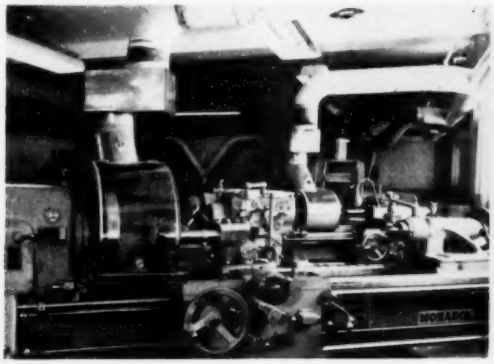


FIG. 1—LATHE HOOD for machining enriched uranium. Hood door is kept closed when making green or heavy cuts on new pieces, is open as necessary when machining to close tolerances and when wet polishing

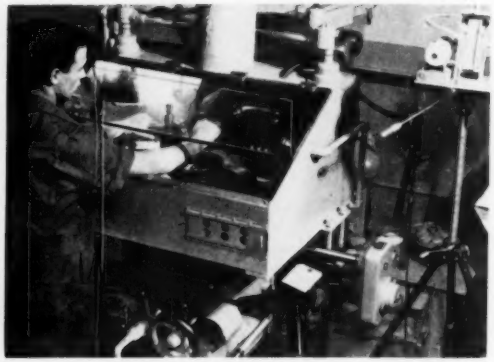


FIG. 2—MILLING MACHINE HOOD has proved one of the more satisfactory machine hoods in use at Los Alamos. Entire cover is hinged, may be lifted and propped open

Exhaust Ventilation for Machining Metals of High Toxicity

By H. F. Schulte, E. C. Hyatt and F. S. Smith, Jr.
Los Alamos Scientific Laboratory

Many of the metals used in the Atomic Energy Commission program are of high or unknown toxicity, making enclosures and exhaust ventilation for machining operations necessary. The factors involved in designing such hoods and several types of hoods which are successfully used are described and pictured

THE HIGH OR unknown toxicity of metals used in the Atomic Energy Commission program has made it necessary to apply exhaust ventilation and enclosures to many machining operations. In the past the materials used in the machine shop have been largely those of low toxicity and machining operations have not produced the high concentrations of metal dust and fumes necessary to cause a hazard. An exception is cast iron machining with its production of nuisance dust. Exhaust ventilation for the control of this material has recently been described.[1] Exhaust ventilation has also been used for the control of oil mist from certain machining operations. However, in recent years a number of less familiar metals are being machined, and some of these have a relatively high order of toxicity and thus a low maximum permissible concentration in air. For this and other reasons, it has been necessary to apply ventilation and, in some cases, enclosure of these operations. Descriptions of some of these hoods have appeared in the project literature and elsewhere.[2]

This document is based on work performed at the Los Alamos Scientific Laboratory under the auspices of the Atomic Energy Commission. It is published here by permission from the American Medical Association's *Archives of Industrial Hygiene and Occupational Medicine*, January, 1952.

Factors Affecting Hood Designs

In designing hoods for this purpose the engineer must take into account a number of factors—some old and some new.

1) The order of toxicity of the

[1]Kane, J. M.: Scrapbook of Exhaust Hood Design, Heat. & Vent. 47; 86-87 (Sept.) 1950.

[2]Gold, S. S.: Hooded Machines Run Toxic and Radioactive Jobs, Am. Machinist, Feb. 19, 1951, pp. 133-135. Bohlin, N. G., and Gold, S. S.: Machine Tool Hoods, ANL-4418, March 1, 1950 (unclassified). Taub, J. N.: The Design of Special Hoods for Machine Tools, AECD-3048, Aug. 20, 1948 (declassified). Pinto, N. P.: Control of Atmospheric Beryllium, Metal Prog., March, 1950, pp. 345-349. Baumann, W. H.: A Practical Control Program of Health Hazards in a Metallurgical Research Laboratory Indust. Hyg. Quart. 10: 143-155 (Sept.) 1950.

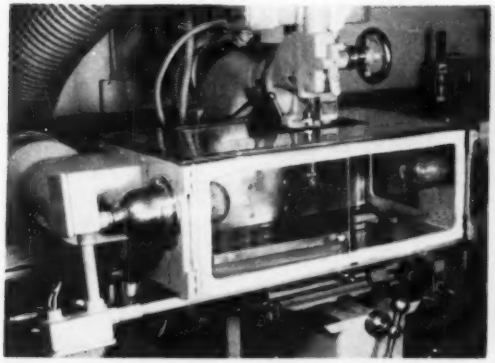


FIG. 3—INDEX MILL HOOD, which was designed in such a way that there would be a large degree of flexibility for the tool head

FIG. 4—SHAPER HOOD, which was designed primarily to prevent loss of material and contamination in the workroom

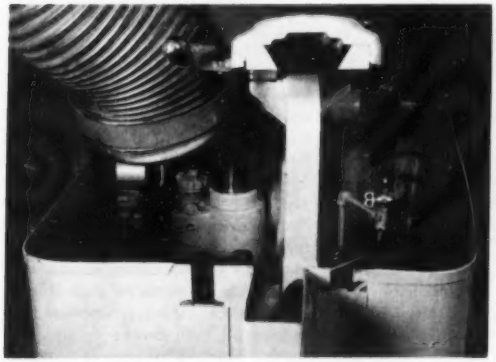


FIG. 5—POWER HACK SAW enclosure, the primary functions of which are to retain in a small area the dust generated and to permit the 8 in. duct to exhaust it

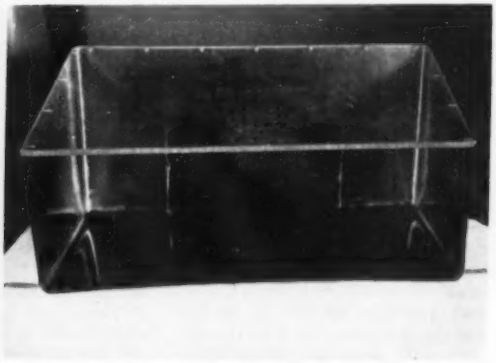


FIG. 6—SIMPLE HANDWORK HOOD makes it possible to perform such work as filing, sanding and cleaning small pieces without contaminating the workroom air

metal to be machined is naturally the most important factor. The term "toxicity" as used here includes any effects of the radioactivity of the metal, as this is an aspect of its toxic effect. The maximum permissible concentrations are not based on lengthy experience as in the case of some other substances. However, tentative approximate figures are being used and are shown in Table 1.

The first three metals of Table 1 have the same maximum permissible concentration in terms of radioactivity but considerably different permissible concentrations in terms of micrograms per cubic meter of air. Data are also needed on such rare earth metals as cerium and lanthanum and on tool metals such as tungsten (wolfram), tantalum, columbium (niobium), and others. In fact, there are few metals in the periodic table which have not been handled in the Los Alamos machine shops. Some metals, such as lithium, are even more dangerous from the standpoint of fire than from that of health.

2) The intrinsic value of the substances machined may require design such that even the smallest chips and turnings can be recovered. Screens and settling boxes for coolants are quite essential.

3) The pyrophoric nature of some of these materials, especially uranium, requires an adequate supply of coolant inside the hood. Wherever possible, the hood is designed to maintain a layer of water standing inside to quench chips.

4) Other physical properties of the materials also affect the design. The high density of some materials means that relatively small particles have considerable inertia, making them difficult to collect. Such particles also tend to settle out in ducts. The quantity of dust and fume generated is partly determined by the character of the oxide formed—whether it is adherent or loose.

5) The type of machine to be hooded and the operation to be performed obviously control the hood design. While it is desirable to have as much enclosure as possible, visibility, flexibility and ease of manipulation are extremely important.

TABLE 1—APPROXIMATE maximum permissible atmospheric concentrations of metals used at Los Alamos

	μg/CuM*	μc/CuM†
"Natural" uranium ...	50	3×10^{-8}
Enriched uranium	0.2-1.0	3×10^{-8}
Thorium	100	3×10^{-8}
Beryllium	2	.....
Thallium	150	.....
Lead	150	.....

*Micrograms of metal per cubic meter of air.
†Microcuries per cubic meter of air.

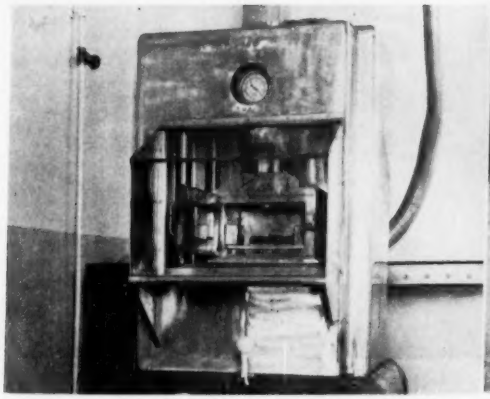


FIG. 7—BREAK PRESS HOOD. Pieces of enriched uranium that are to be remelted are broken in this press. Breaking unit itself is enclosed in small exhausted metal box inside large hood enclosing entire machine

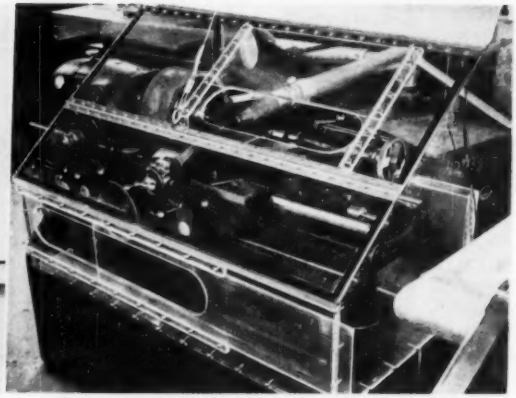


FIG. 8—LATHE HOOD for lathe used to machine beryllium parts. Hood encloses working area, and in addition a 3 in. duct extends to a point adjacent to cutting tool to capture dust at its source

Clear plastic is used as a construction material to provide visibility. Wherever possible, all machine controls are kept outside the hood for ease of operation and for protection against contamination. If the hood interferes with the machinist's work, it will not be used properly, and high atmospheric concentrations will result.

6) The depth of cut, the rate of tool travel and the speed of turning will greatly affect the size and shape of hood required, or may even determine whether any hood is needed. Even the type of coolant employed affects the rate at which materials escape into the air.

7) The size and shape of the pieces to be machined naturally regulate the size and shape of the hood. In most cases, it is necessary to provide great diversity in such factors.

8) Decontamination of the hood must be made as easy as possible, and for this reason stainless steel is used for the metal parts of the hood. It is useful to compare the design of this equipment with that required on modern food handling equipment.

Types of Hoods Used at Los Alamos

Hoods incorporating most of these considerations are illustrated. These hoods have been modified continually to improve their collecting ability and it is not suggested that they represent the ultimate in design.

The analysis of air samples collected in the breathing zone and in the general room air has been the standard against which hood performance has been measured. The hoods shown have been capable of maintaining atmospheric concentrations below the maximum permissible levels when used properly.

Lathe Hood.—The two lathes shown in Fig. 1 are used to machine enriched uranium; construction is of plastic and stainless steel. The hooded lathe in the foreground has an average face velocity, when the door is open, of 280 fpm. When the lathe is making green or heavy cuts on new pieces, the hood door is kept closed. It is often necessary to open the hood when machining to close tolerance and when wet polishing is done. The air velocity is such that these operations can be done safely. The box located in the exhaust duct above the machine is a chip trap. The duct velocity is so high that chips of metal are occasionally caught and sucked into the exhaust duct.

Milling Machine Hood.—The milling machine hood (shown in Fig. 2) has proved to be one of the more satisfactory types of machine exhaust hoods in use at Los Alamos. The operation of the hood shown, with the section of the door open, represents the correct manner in which the hood should be used. Under these conditions a face velocity of 275 fpm is obtained. The entire cover is hinged and it is possible to lift it and prop it open. This permits accessibility for setting up, adjusting tools and other procedures. The six small holes on the front of the hood make it possible to draw air through the hood when the door is closed.

Index Mill Hood.—This hood (Fig. 3) was designed in such a way that there would be a large degree of flexibility for the tool head. The nature of the operation is such that only a small amount of dust is generated when drilling pieces, and it is thrown off with comparatively little force. The hood is usually operated with half of the front open, giving a face velocity of 200 fpm. The opening on top of this hood, which allows freedom of movement for the tool head, has an average face velocity of 300 fpm.

Shaper Hood.—The shaper ejects material with considerable velocity, and this hood (Fig. 4) was designed primarily to prevent loss of material and contamination in the workroom, although it also maintains low concentrations of metal in the air. The many doors are necessary in order to permit the machinist to make a variety of adjustments while operating the shaper.

Power Hack Saw.—The primary functions of the enclosure shown in Fig. 5 are to retain in a small area the dust generated and to permit the 8 in. duct shown at the top to exhaust adequately the dust generated during sawing. There may be better ways to exhaust such a saw, but this unit has proved satisfactory in controlling airborne contamination.

Handwork Hood.—The simple hood

shown in Fig. 6 makes it possible to perform many types of handwork, such as filing, sanding and cleaning of small pieces, without contaminating the workroom air. The face velocity is 385 fpm.

Break Press Hood.—Pieces of enriched uranium that are to be remelted are broken in the press shown in Fig. 7 for loading into the furnace. The breaking unit itself is actually enclosed in a small exhausted metal box inside the large exhaust hood enclosing the entire machine. When the door on the small box is open, there is a face velocity of 500 fpm to prevent the escape of dust. The face velocity of 550 fpm for the large opening is produced by the air exhausted through both the small box and the larger hood.

Lathe Hood.—The lathe shown in Fig. 8 is used to machine beryllium parts. The hood completely encloses the lathe working area and, in addition, a 3 in. duct extends to a point adjacent to the cutting tool to capture the dust at its source of generation. This exhaust duct is visible through the upper open ports. It has a screen over the end to prevent large chips from entering the duct. The chuck itself is enclosed to prevent dispersion of dust which may move into its sphere of influence. To operate efficiently, at least the upper part of the large door must be closed. The commonest way of operating this hood is shown in Fig. 9. Under this condition, there is a face velocity of 250 fpm.

Grinder Hood.—The surface grinder shown in Fig. 10 is used for beryllium metal. It is necessary to use a small exhaust duct, shown on the right, to permit an airtight sliding fit to accommodate the moving bed. A baffle stops the heavier dust thrown off by the grinder, and a velocity of 300 to 500 fpm through the openings in the hood adequately exhausts it.

The volume of air drawn through these hoods varies somewhat with the number and the size of openings required for specific jobs. Data on this point for the hoods as normally used are shown in Table 2.

With these operating conditions it has been possible to maintain air concentrations as shown in Table 3.

The figures given for general air samples represent data taken in the workroom during the entire workday and are averages of a very large number of samples in most cases. The breathing zone samples were taken at intervals.

With careful precleaning of castings, regulation of machining rates, and use of adequate coolant, it has been possible to machine normal uranium without hoods. However, plans are being made to provide nonenclosing type hoods on some machines where pieces of unusual size or shape must be machined, or where higher machine rates must be employed. Wherever possible, machining of other metals of unknown toxicity is carried out on hooded equipment.

TABLE 2—VENTILATION of machines

Machine	Principal metal machined	Vol. of Air, Cfm	Maximum working opening	
			Area, Sq ft	Face Velocity, Fpm
Lathe	Enriched uranium	500	1.8	280
Milling machine	Enriched uranium	390	1.4	275
Index mill	Enriched uranium	330	1.7	150-225
Shaper	Enriched uranium	540	2.7	200
Power hack saw	Enriched uranium	600	.....	.....
Handwork hood	Enriched uranium	500	1.3	385
Break press	Enriched uranium	1,200	2.2	550
Lathe	Beryllium	200-250	0.75-2.5	100-270
Grinder	Beryllium	Variable	Variable	300-500
Lathe	Thorium	100	Not enclosed	.....

TABLE 3—AIR CONCENTRATIONS during machining operations

Machine	Principal metal	Average concentration, μg/Cu M*	
		Breathing Zone	General Air
Lathe	Enriched uranium	0.10	0.23
Milling machine	Enriched uranium	0.35	0.23
Index mill	Enriched uranium	0.16	0.23
Power hack saw	Enriched uranium	0.32	0.23
Break press	Enriched uranium	....	0.18
Lathe	Beryllium	0.49	0.26
Grinder	Beryllium	0.33	0.15
Lathe	Thorium	14.0	....

*Micrograms of metal per cubic meter of air.

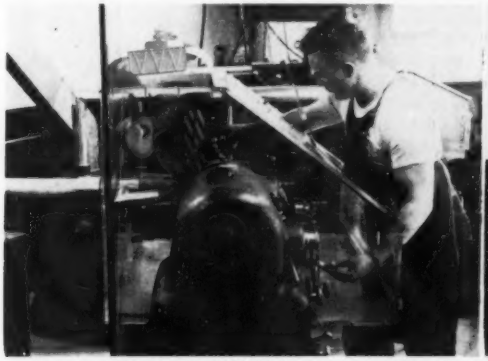


FIG. 9—THE MOST COMMON way of operating the hood shown in Fig. 8

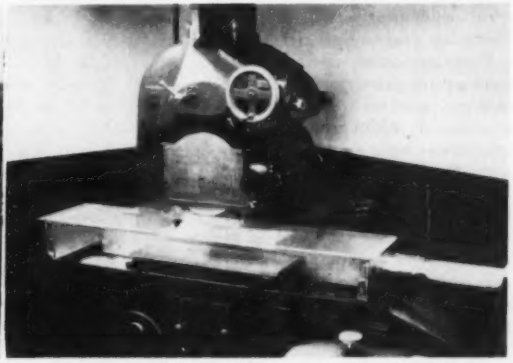
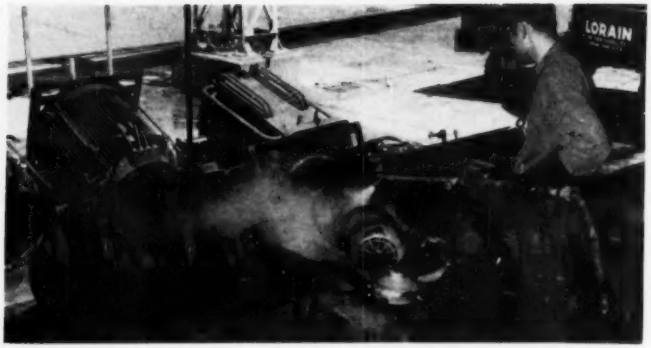


FIG. 10—GRINDER HOOD uses a small exhaust duct, shown at the right, to permit an airtight sliding fit



AFTER TAGGING and recording receipt of apparatus, a steam bath was the first step in the actual rehabilitation of the equipment. Here, a worker is in the process of removing oil and grease from end bells, armatures, and stators. Next in line are some large power transformer shells. This steam bath removed the major portion of grime and grease

Rehabilitating Equipment After a Flood

"Field Notes" on Some Lessons Learned

SOME "FIELD NOTES" recording a few of the lessons learned at the emergency repair shop set up in Kansas City by the Westinghouse Electric Corp. for the rehabilitation of electrical equipment damaged in the floods last year are given here:

Pumping station electrical equipment got top priority. The electrical utilities received second highest priority. In addition to the utilities, companies having anything to do with the food and water supply, health, and transportation were given the highest priorities possible.

Motors that were essential — such as compressor motors, pump motors, and certain machine tool motors — were given "A" priority (24 to 48 hr service from time of receipt to time of completed repair.) All equipment used for maintenance — that is, for cleaning up after the flood — was given the top repair priority.

After the first rush orders were handled, repair scheduling was based on the clean-up schedule of the plant involved, for some plants took longer to dig out than others.

A typical manufacturing and repair shop would have a complement of about 40 or 50 people. The following is a list of the equipment that was either borrowed, brought in, or rounded up from the immediate vicinity: Trucks, steam cleaners, motor operated cranes, vapor degreasers, caustic tank, solvent tank, lift trucks, "A" frames, chain hoists, paint spray booths, spray guns, test instruments (both d-c and a-c), oil testers, welding equipment, lathes, ovens (six ovens were in use at one time), bearings, varnishes, insulating material, copper wire and copper parts, and laminated plastics.

To supplement the force of specialists and engineers gathered for this emergency work, local people were also hired.

The Rehabilitation Processes

Generally, most equipment could be rehabilitated. In some cases, the extreme age of certain transformers and motors made it cheaper to replace them with new ones. Anything that required extensive rewinding was sent to one of the manufacturing and repair plants outside the flood area. Practically all house-type socket meters were replaced, but most instruments were rehabilitated.

Approximately 95 percent of all the motors that were flooded were cleaned and returned to service without rewinding. Approximately 96 percent of all the transformers that

were flooded were cleaned and returned without rewinding. Rehabilitation of control and switchgear usually required complete replacement of certain parts, such as wiring and units that cannot withstand the heat used in the drying process.

Following are "rundowns" of the procedures used to repair motors and generators, transformers, switchgear, and appliances.

Transformers

(1) Clean with high pressure fresh water.
(2) Check insulation with a megger meter — check water content of oil with oil tester.
(3) If megger meter reading is positive, flush with new oil.
(4) If core insulation test is negative, pull core.
(5) Clean with steam or solvent.
(6) Bake core in 250 F oven — test every 24 hr with megger meter.
(7) Clean tank with solvent or steam and dry with compressed air or heat lamps.
(8) Install new gaskets and bushings, if necessary.
(9) Replace dryed core in tank.
(10) Paint and ship.

Motors and Generators

(1) Clean with high pressure water.
(2) Disassemble.
(3) Clean parts with steam or solvent (end brackets and bearings were cleaned in degreaser.)
(4) Wash open type bearings with solvent. After washing, cover with oil (if not, corrosion takes place almost immediately.)
(5) Bake stators, wound rotors, d-c fields, d-c armatures at 250 F for 24 hr — check with a megger meter (must read one megohm or better.)
(6) Spray motor coils with air drying insulating varnish.
(7) Reassemble.
(8) Give megger, ground, and running tests.
(9) Paint and ship.

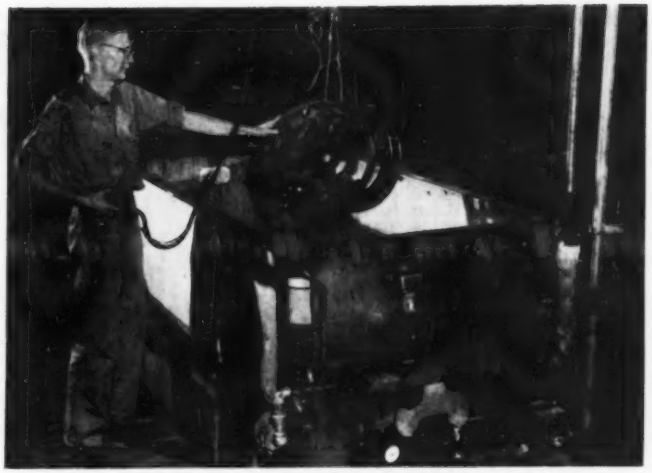
Switchgear

(1) Clean with high pressure water.
(2) Dismantle.
(3) Steam clean steel parts, but use a solvent for auxiliaries switches, instrument switches, and laminated plastic parts.
(4) Install new wiring on practically all oil breakers (wiring was destroyed by chemicals from submerged chemical plants and oil refineries.)
(5) Install new "Rectox" units.
(6) Dry laminated plastic parts with heat lamps.
(7) Assemble and paint.
(8) Ship.

(Skilled engineering and service department people were brought in to supervise rehabilitation of switchgear because of the intricate nature of this equipment).

Fixed Appliances

(1) Wash off surface muck and dirt with clean water.
(2) Steam inside and outside to remove grease and oil films.
(3) Remove liners (refrigerators and stoves).
(4) Steam inner walls.
(5) Sterilize in chlorine solution.
(6) Air dry.
(7) Install new insulation.
(8) Replace liners.
(9) Replace controls.



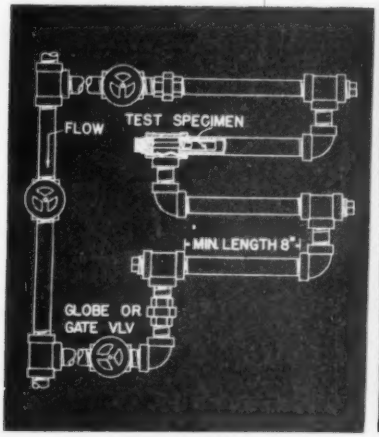
SEVERAL MEANS were available for degreasing and degriming equipment. Here, a trichlorethylene vapor degreaser is about to receive some end bells

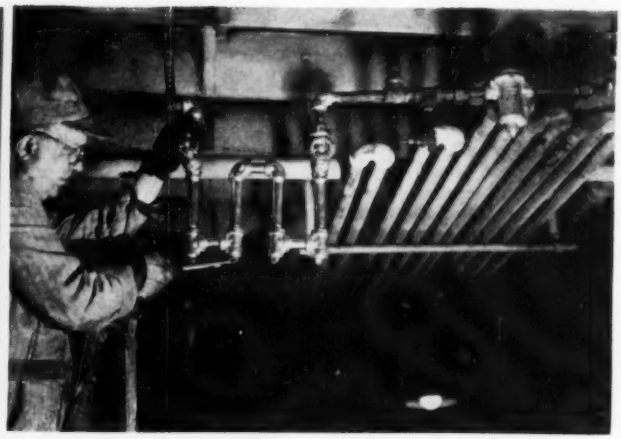
THE LAST STEP IN the rehabilitation process for a motor is a good coat of paint. A special spray booth was provided for this purpose

PATENT ON CLAMP FOR EXTRACTING PIPES

AMONG THE PATENTS held by the Atomic Energy Commission and which have been transmitted to the U.S. Patent Office for registry and listing is No. 2,584,301, covering a "pipe extractor." It describes a novel clamp suitable for extraction of vertical pipes from locations which are inaccessible. The clamp, which may be suspended at the end of a single supporting cable, is operated by remote control to lower it into the end of the pipe and then manipulate to grip and remove it.

The AEC will grant non-exclusive, royalty-free licenses on this and the other listed patents.





THE CORROSION TEST BARS consisted of solid low carbon steel strips 1/16 by ½ by 3 in. . . . . TEST SPECIMENS were inserted in eight areas of the plant for periods of two to four weeks

Protecting Condensate Piping, Heating Units Against Corrosion

By G. A. Mierendorf
A. O. Smith Corp.

CORROSION IN CONDENSATE return lines, steam traps and heating units represents a hidden cost of maintenance in steam heating systems. The deposits and contamination resulting from this corrosive action are also reflected in sluggish heating operation and possible damage to boilers.

The selection of filming amines to correct these problems in our plant was based on the results obtained in comparison to other materials used.

90 Million Cu Ft Volume Heated

The plant (situated in Milwaukee) covers 130 acres, with over 50 buildings comprising a building heating volume of 90 million cu ft. It is divided into two sections by a main railroad line, thus forming two separate areas served by three boiler plants. The diversified manufacturing engaged in has resulted in buildings of varying heights with a variety of heating equipment.

Steam is furnished for heating and process with an average of 50 percent of the condensate being returned. Lake Michigan water is used for make-up and is conditioned with internal treatment. The same steam mains satisfy both heating and process needs, thus offering little opportunity to drain heating units and lines during the summer season. This condition served to increase the damage due to corrosive action.

Conditions of the heating system were critical from the standpoint of maintaining heat in buildings with an unusual amount of heater failures and piping replacements. Examination of unit heaters showed failures of the core tubes, generally in the vicinity of the manifold both top and bottom. Piping failed at the threaded connections where the pipe wall thickness was reduced. Specimens of the pipe showed evidence of severe grooving at the bottom of the pipe due to the formation of carbonic acid, and pitting attributed to oxygen was evident over the entire inner area. Strainers on the inlet side of the condensate pumps deteriorated to a point where they were useless and portions therefrom contributed to wear of the return pumps. The cor-

This paper was given at the first annual meeting of the American Power Conference (formerly the Midwest Power Conference), which is sponsored by the Illinois Institute of Technology with the cooperation of several colleges, universities and engineering groups.

Corrosion in heating units and return lines should be given careful consideration in the light of increasing man-hour maintenance costs and shortages of materials. It is difficult to exclude oxygen — and, in some cases, harmful carbon dioxide — concentrations to a sufficient degree. Where conditions point to the need for corrosion-preventing additives, careful consideration should be given to the selection of the material that will do the work best in the particular plant. A method should be selected to determine the results being obtained, in order to justify the cost of additives

rosive action also took its toll of steam trap mechanisms. Inverted bucket traps removed upon failure showed attack on the bucket proper and frequently extensive corrosion was evident on the top cap within the area of the trap seat. Deposits of iron oxide in the body of the trap, and throughout the entire return system and the boiler, were common. These deposits contributed to developing a sluggish and contaminated return system. The cost of repairing and replacing heating equipment and condensate return lines amounted to a sizable figure.

Exhaust from Turbines Stresses the Problem

The growing concern with the corrosion problem in industrial plants may stem to some extent from the fact that the use of exhaust steam from reciprocating engines is being replaced by the exhaust of steam turbines. With reciprocating equipment emitting oil in the exhaust steam, the corrosion potential in the heating system is arrested.

A good comparison of these conditions existed in this plant. One section of the plant used reciprocating engines for fan power and exhausted steam into the heating system. This section of the plant was not affected to any great extent by return line corrosion. The newer section of the plant had no reciprocating equipment and used line pressure and steam at reduced pressures directly from the steam source for heating. This section of the plant was noticeably affected by corrosion.

It was apparent that the high replacement cost of heating equipment could not continue and that steps would have to be taken to reduce this cost. In looking to corrective measures, the activity centered about the steam generating plants first — to produce steam of highest purity consistent with the equipment in use. To get an idea of the extent of the problem, checks were made on condensate returning to the steam plants. The samples of return condensate indicated a pH value of 5.8 to 6.2 and appeared cloudy and discolored. Deposits in condensate return pumps were chiefly magnetic oxide of iron (Fe_3O_4) and traces of ferric oxide (Fe_2O_3). With the use of continuous recording equipment, investigation of steam samples showed excellent purity from a standpoint of carryover, with specific conductance values corrected for ammonia and carbon dioxide of approximately 0.8 micromhos equivalent to 0.4 ppm dissolved solids. The average CO_2 concentration of the steam was 43 ppm.

The use of soda ash had been discontinued in the boiler plants because of its higher CO_2 potential, and caustic soda used in its place. Sodium sulfite was added to the feedwater after the heater to react with residual dissolved oxygen, and feedwater temperatures were maintained at 220 to 230 F at 5 to 7 psi, with a generous vent provided for the removal of both corrosive and other noncondensable gases. It may be well to mention at this point that the installation of external water softening and conditioning equipment was not considered practical in view of future plans under consideration.

In looking toward the possibility of treating the steam to obtain protection from corrosion, care had to be exercised to achieve results at a low cost per 1000 lb of steam. As mentioned previously, this system serves both process and heating needs through the same steam mains and with 1 billion lb of steam generated annually, with 50 percent condensate recovered, the cost of treating could very easily be out of range.

Another important factor was to strive for complete coverage over the distance and area of this plant, and to give thought to the extent of protection likely to be achieved during the off-heating season.

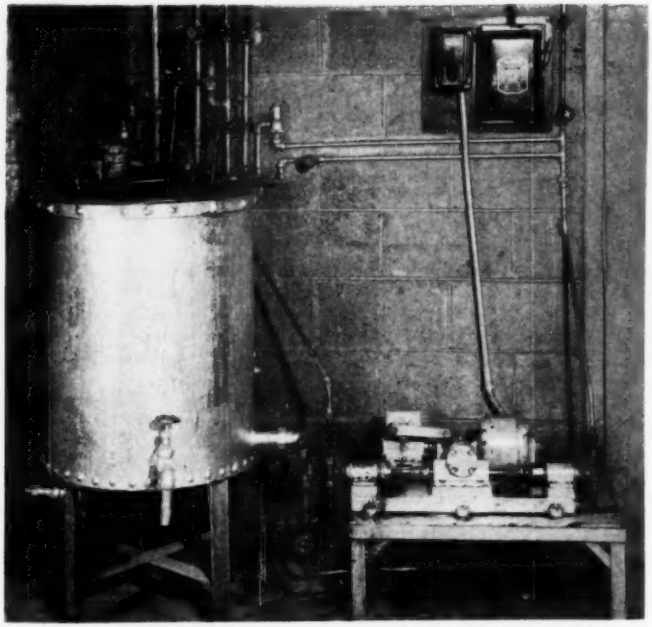
Published reports had accounts of treating steam with ammonia, phosphates, neutralizing amines and filming amines.

Since ammonia was said to be harmful to copper and brass and difficult to disburse over wide areas in the concentrations desired, the use of this material was not considered advisable.

We investigated the use of phosphates to raise the pH value of the condensate and decided to select one building where steam was used exclusively for heating and where results could be observed with this treatment relative to the cost per 1000 lb of steam used. Samples of the condensate taken prior to use showed a pH value of 5.8 to 6.2. The recommended amount of treatment was vaporized in a separate container and proportioned into the steam line entering the building. During a month of operating, no increase in pH was noted at the condensate pump receiver. In checking drip legs throughout the system, we found indications of short circuiting of the phosphate which resulted in unequal distribution. The steam line feeding the lower floors had a pH value of 7.0 to 8.8 and the upper floors had a pH value of 6.0 in the samples of condensate taken, with a pH value of 6.0 to 6.5 at the condensate pump. The points of injection were changed and a new vaporizing machine installed the following heating season. Sufficient treatment was added to maintain a pH value of 7.0 in the system. Results indicated that complete plant coverage would be difficult to obtain. Protection could not be expected in the summer months when heaters and radiators were off, since the pH value would drop shortly after the feed of phosphate was discontinued. The cost of treating steam for protection of condensate lines and heating equipment amounted to an average of 14.2c per 1000 lb of steam.

Neutralizing Amines Tested at West Plant

We undertook to treat the West plant using neutralizing amines. The pH value of the condensate in all buildings averaged 6.0 prior to the introduction of the neutralizing agent. The amine was injected into three steam lines at the power plant, two lines feeding individual buildings



THE PUMPS AND MIX tanks for the injection of amine in the heating and piping systems

and one line feeding five buildings. In one building with steam furnished by one of the steam lines we observed the following: The amine injection had to be maintained over a 24 hr period to assure a pH of 7.0 over the period. As we approached the end of the heating season, where the steam consumption was in the ratio of 20 percent heating to 80 percent process, it became necessary to increase the amine treatment to near 100 percent over the winter season when the ratio of heating to process steam was reversed. It should be mentioned that the condensate from steam for process is not reclaimed.

Treatment to five buildings on one steam line showed irregular results, with pH values ranging from 6.0 to 7.6 over the same 24 hr period throughout the various buildings, buildings with little steam demand showing the lesser pH value. As the heating load decreased and the ratio of process steam to heating reversed, more amine per 1000 lb of steam was required to maintain recommended pH values. The rapid drop of pH values when treatment was discontinued during several periods indicated that a possible loss of protection could be anticipated over the summer season. The cost of treating the steam for protection against corrosion in accordance with the recommended pH values of 7.0 averaged 0.6c per 1000 lb of steam. From these results we concluded that the dependence of volatile amines on the amount of CO_2 in the steam made their use in this plant impractical from a cost and "consistency of pH" standpoint.

Filming Amines Used in East Plant

When we undertook to use filming amines for protection against corrosion, we adopted the methods and procedures considered to be the prevailing practice of the firm marketing the filming amine. It was recommended that we establish a series of test stations throughout the plant where test specimens could be inserted to gage the extent of corrosion as well as the degree of coverage obtained when the filming amines were used. The test bar consisted of a solid low carbon steel strip 1/16 in. x ½ in. x 3 in. in dimensions. The selection of this type of test strip does not coincide with the recommendations of the National District Heating Association calling for three helical test wires insulated from one another. The solid strip was selected, however, for comparative purposes only as pertaining to the conditions in this plant. This type of specimen proved that reliable results could be obtained and in addition was preferred to the helical springs in that the shape and surface of the bars were found to be superior for observing the effect of film foundation such as is produced by the filming amine. These test specimens were inserted in eight areas of the plant for periods of two to four weeks. Two specimens were removed from each area during each interval so as to avoid errors in results obtained.

Work was begun in the East plant according to recommendations. Test specimens were inserted in four areas to evaluate conditions existing in the plant before filming amines were injected. Table 1 shows the results obtained in inches penetration per year.

The filming amine was then injected by means of a chemical pump into the steam headers at the rate of 15 lb per 1 million lb of steam, and new test specimens were inserted at the test stations. The results in inches penetration per year are shown in Table 2.

With the test specimens in use, a value of 0.005 in. penetration per year or less is established as the criterion of good protection. These results served to indicate that the corrosion potential was present and that filming amines would thwart the action.

An Unanticipated Operating Problem

After using filming amines for a short while, we developed an operating problem that was not anticipated.

TABLE 1— BEFORE filming amines were injected

Bldg.	Time	Inches Penetration per Year
A	2 weeks	0.0112
B	2 weeks	0.0104
C	2 weeks	0.0009
D	2 weeks	0.0040

TABLE 2 — AFTER amines were injected by chemical pump

Bldg.	Time	Inches Penetration per Year
A	2 weeks	0.0004
B	2 weeks	0.0024
C	2 weeks	0.0009
D	2 weeks	0.0022

While the filming amine did coat the internal surfaces of the piping with a monomolecular film, it also loosened scale particles, packing waste, oil and whatever deposit was present.

Steam traps began to fail and strainers became clogged. The preventive maintenance trap inspection showed a rise in trap failures attributed to foreign matter and it was decided to increase our activity in trap inspections and continue cleaning until the system contamination was removed. In some cases the installation of sediment chambers and blowout lines before the traps simplified the cleaning problem. After one heating season, the trap and strainer troubles receded to spotty failures that could be considered normal to heating operations.

To avoid a failure of traps to the extent experienced at our plant, it may be advisable to feed the filming amine at a lower rate than recommended for the first few months and gradually increase the rate to achieve the desired protection. In this manner, the system will discharge foreign matter at a rate that can proceed without fouling traps and strainers. In our case we were interested in correcting and relieving the corrosion difficulty as quickly as possible and — frankly — were not aware of this characteristic of the filming amines until the problem arose.

Another difficulty encountered with the use of filming amines was a tendency for reducing valves to fail to respond when opened at the beginning of the heating season. This was especially true with valves on branch connections of the steam system, where little steam was used during the summer season. Examination of the internals of these valves showed a gummy deposit that could be washed clean with hot water. When a condition such as this arises, the accumulation clears itself by reevaporation once the valve is lifted off the seat and steam is circulated through the body of the valve.

TABLE 3 — DATA ON TEST specimens — averages for three-year period

Bldg.	No. of Specimens	Inches Penetration per Year
A	9	0.0009
B	10	0.0018
C	6	0.0014
D	9	0.0003
E	5	0.0017
F	6	0.0019
G	6	0.0006
H	4	0.0043

Following the test run with filming amines, we continued with the insertion of test specimens that were exposed to the condensate for three-month periods as a guide to observe overall plant coverage. Due to conditions prior to the use of filming amines, we have had to replace some sections of return piping and occasionally a unit heater. At this time we observe the internal condition of the pipe and immerse a section in water to observe the presence of filming amine. When amine is present there is not a trace of water adhering to the pipe internal. While there is a question as to the length of time that the film will remain effective, we have observed the presence of filming amines throughout the system in the summer when heating units are not in operation, and we feel that we are achieving at least some degree of protection during these periods.

Results of the Treatment Scheme

Average test specimen data for the plant over the last three years is given in Table 3.

The values in Table 3 serve as indicators relative to the degree of coverage in the plant; the values no doubt vary due to the rate of flow of the condensate, temperatures of condensate, and quantity of oxygen introduced into the system (along with other factors.)

The cost to treat steam with filming amines for protection again corrosion averaged 0.3c per 1000 lb of steam.

Maintenance Costs Are Decreased

The cost of maintaining the main condensate return lines and a small percentage of plant heating in leaks, heating failures and the like that were attributable to corrosion was $4500 per year. Over the past two years, this cost has decreased to $1500 per year.

There are 635 unit heaters in this plant and replacements due to leaky heaters numbered 16 to 24 units per year. Present replacements average four to six units per year. This saving is estimated at $2500 annually. The condensate mains and unit heater maintenance cost has decreased $5500 per year as against an expenditure of $3000 for filming amines.

The cost of replacing nipples, traps and returns to the condensate mains is absorbed by 11 manufacturing divisions operating as separate units and the reduction in maintenance cost of this equipment is not taken into account in the cost figures given.

THE PLANT covers 130 acres, has over 50 buildings comprising a building heating volume of 90 million cu ft

How To Care for Unit Heaters

Industrial Unit Heater Association gives practical suggestions on the care and maintenance of steam and hot water unit heaters

UNIT HEATERS, like all equipment, require regular care and maintenance if the operator is to realize the economy and efficiency inherent in systems using them. The Industrial Unit Heater Association — in a copyrighted bulletin issued last month — has outlined the general essentials of such care and maintenance, which should be supplemented by the specific instructions of the manufacturer because of differences in construction.

Regular, scheduled maintenance is not an expensive operation. It pays large dividends in trouble-free operation and is the mark of a well operated system, the association points out.

Installation Essentials

Heating system design is not covered here for it is assumed that this work has been carried out in accordance with established engineering principles. Some matters will be touched on, however for their omission can cause persistent trouble in operation.

Branches from Steam Supply Main

The branch connecting the unit heater to the steam supply main should be pitched down from the heater and be taken off from the top of the main. Do not drip the main through the heater since entrained condensate will reduce its capacity. The return connection must be pitched down from the unit so the condensate will drain freely.

Low Pressure Gravity Systems

Float traps and check valves, if the latter are used, require a head of water above them before they will operate. If they are not placed well below the bottom of the heater, condensate will back up into the heating element and trouble as well as a drop in capacity will result. Place the trap or check valve 10 in. below the bottom of the heater and extend a dirt trap 6 in. below this. Do not bush the heater but run full size to the strainer. Make sure that there is an adequate air vent valve installed in closed return systems.

Vacuum Systems

The precautions given above apply equally to vacuum systems except that vent valves are omitted. If thermostatic instead of float and thermostatic traps are used, a cooling leg must be provided ahead of the trap.

High Pressure Systems

Install the bucket or high pressure float trap at least 10 in. below the bottom of the unit together with a 6 in. dirt trap. Provide a petcock for venting and for continuous air bleed. Where possible, it is advisable to use reducing valves in the supply main so that the units may operate at lower pressures.

Strainers

While strainers are not essential, it is recommended that they be installed between the unit heater and the trap or check valve, if the latter is used. They should be placed in the supply if the unit heater is equipped with steam distributing tube coils.

New Unit Heaters

Inspect new unit heaters carefully before operating. Normally, no attention is needed, but it is a wise precaution. Check to see that the wheel is in the proper position and tight on the shaft. Tighten any loose nuts and bolts. Remove and carefully save operating instructions. If necessary, lubricate as directed, but don't overdo it.

Check the line voltage. A wide swing or change from high to low voltage can result in a burned out motor.

Maintenance of Units

Regular Inspection

The most important factor in trouble-free and economical operation is regular inspection. Make a simple check sheet showing the date of inspection for each heater. In normal operation an inspection every four months should be sufficient. If the atmosphere is extremely dirty, more frequent inspections are needed. Check for dirty heating elements, loose connections and excessive vibration; clean the fan and the outside of the motor.

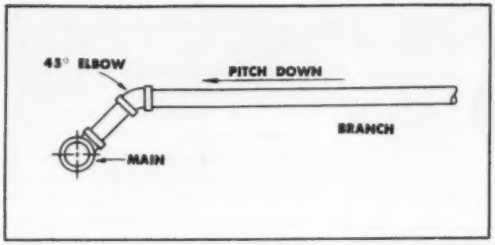
Motors

Follow the motor manufacturers' instructions. Different types of motors are applied to unit heaters and general rules are hard to draw. Again, save the tags or instructions supplied with the unit, and if they are missing it is suggested that either the motor manufacturer or the unit heater manufacturer be written for the information, giving the complete motor nameplate data.

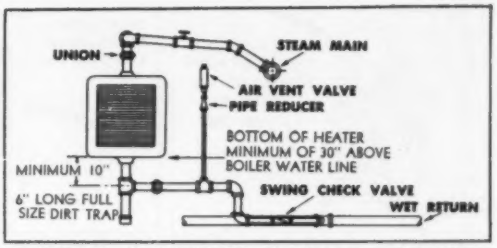
A separate, manually operated, thermal overload starter is recommended for each unit as well as properly sized fuses.

Lubricate motors in accordance with the manufacturer's instructions.

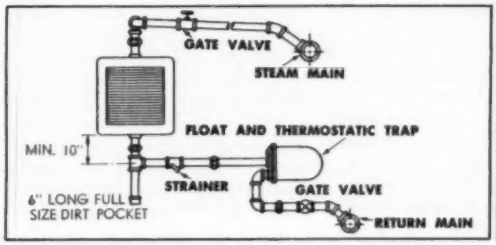
Ball bearing motors are shipped with the bearings packed in grease. This lubricant is usually sufficient for one year's operation. *Warning* — If the motor has a fitting for a pressure gun, be very careful not to over-lubricate, for the motor can be damaged if the lubricant reaches the rotor. First remove the pressure relief plugs to allow the old grease



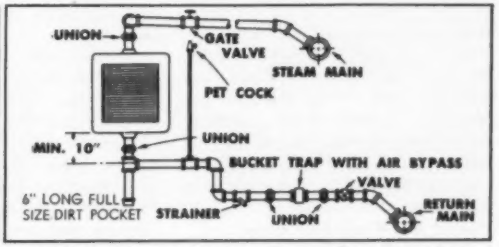
BRANCH CONNECTING unit heater to steam supply main should be pitched down from the heater and be taken from top of main



THE TRAP OR CHECK valve should be 10 in. below the heater on a low pressure gravity steam system and a dirt trap extended 6 in. below this



IF THERMOSTATIC instead of float and thermostatic traps are used on vacuum systems, a cooling leg must be provided ahead of the trap



INSTALL BUCKET OR high pressure float trap at least 10 in. below bottom of unit on high pressure system, with a 6 in. dirt trap

to flow out. Use the high temperature grease recommended by the manufacturer.

Sleeve bearing motors are normally equipped with wool packed, oil lubricated bearings. Use a recommended type of oil. Fill the cups before operating a new unit heater and refill approximately every 2000 hr. Do not over-lubricate.

Heating Elements

Clean the heating elements at least once a year and more often if the unit is operating in a dirty or corrosive atmosphere. Dirt can seriously reduce the heating capacity of the unit. Dirt may be removed by brushing the fins on the side where the air enters the unit and then turning on the fan. It is recommended that a bag be placed over the face of the unit to catch the dirt. High pressure air can be effectively used by blowing out the element from the side where the air flow leaves it. If a very thorough cleaning is needed, remove the unit and spray the heating element with a mild alkali cleaning solution and rinse well afterward. A steam gun can be used for cleaning and rinsing.

Fan

Clean the fan at periodic intervals. A dirty fan will get out of balance and cause noise and excessive vibration, and may damage the bearings. Check to see that the fan is in the proper position and that set screws are tight.

Casing

During inspections clean the casing and remove rusted or corroded spots. Retouch with paint.

Internal Corrosion

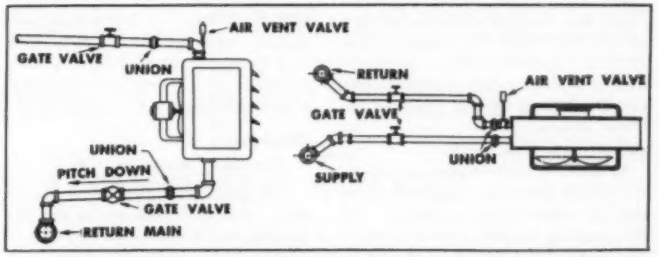
Prevention of internal corrosion not only protects the unit heater but also the whole heating system. In major installations it is advisable to consult water treatment concerns on boiler water treatment. Deaerate the boiler feedwater, particularly when large amounts of make-up water are used. Use boiler compounds with care and sparingly; excessive amounts can carry over into the steam and form an acid condition that will attack the heater. Too much compound can cause a boiler to foam and load the system with water; in this case, drain and refill the boiler until the foaming stops.

Adequately vent the units to remove air from the system, especially on high pressure steam systems.

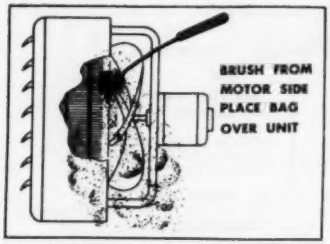
Make sure that the condensate drains quickly and completely. If it lies in the unit, corrosion may occur, heating capacity will be lowered, and water hammer may also follow. Condensate in the unit can freeze when the heater is not in operation and break the heating element.

Traps, Check Valves, Etc.

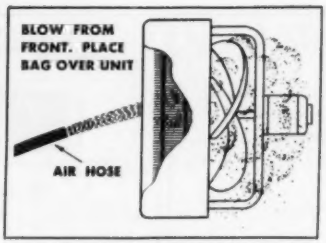
It is recommended that traps be used instead of check valves. This equipment must also be inspected periodically for worn parts that leak



UNITS IN FORCED HOT WATER systems should be equipped with suitable air vent valves or other means for the complete and rapid removal of air



CLEAN THE HEATING ELEMENTS at least once a year and oftener if the atmosphere is dirty or corrosive



HIGH PRESSURE AIR can effectively be used for cleaning by blowing out the heating element from the side where the air flow leaves it

or stick. Bellows that do not function may cause the unit to be air-bound. Jammed parts will not allow the condensate to drain quickly and trouble results. Traps should be selected on the basis of the condensate to be handled, and not on the pipe size. In case of doubt, consult the trap manufacturer. Clean strainers regularly.

Forced Hot Water Unit Heaters

Units in forced hot water systems should be equipped with suitable air vent valves or other means for the rapid and complete removal of air. Make sure that the units can be completely drained if the system is shut down in freezing weather. It is well to sectionalize the system so that units can be changed without draining the whole system.

Blower Type Unit Heaters

In addition to the matters previously covered, attention must be given to the fan shaft bearings, motor, and the coupling or belt drive on blower type units. The fan shaft should be inspected for end play, worn bearings and loose set screws. Follow the manufacturer's lubrication instructions. Service sleeve bearings often enough to maintain the oil at the proper level — at least once every three months. Ball bearings should be carefully greased every three months.

If the unit is direct connected, check the coupling for alignment and wear. Many units of this type have V-belt drives which must be checked for proper pulley alignment and wear on the belts. If it is a multiple V-belt drive, replace all belts with a matched set if one is worn; do not replace one belt only. Check the motor hold-down bolts and tighten if loose — but make sure the motor alignment is correct after doing so.

These units are sometimes equipped with air filters. If they are allowed to clog with dirt the air circulation and heating capacity will be greatly reduced. If the unit is so equipped, clean or replace filters regularly.

Discussion of System Corrosion

The chief cause of corrosion in the tubes of unit heaters and in the connecting return lines is carbon dioxide which, with condensate, forms carbonic acid. Oxygen is sometimes present in steam and accelerates carbonic acid corrosion.

Carbon dioxide is generated in the treatment of the boiler water and has its source in the carbonate constituents. Under heat, when the steam is generated, the bicarbonates break down to form carbonates, water, and carbon dioxide. Under the higher pressures and accompanying temperatures, carbonates will break down and form caustic soda, water, and carbon dioxide.

Carbon dioxide can be removed or neutralized by the use of a deaerating feedwater heater, employing the blend system, acid treatment system, and degasifier or demineralizing system. Volatile alkalies may also be added internally to control carbon dioxide corrosion.

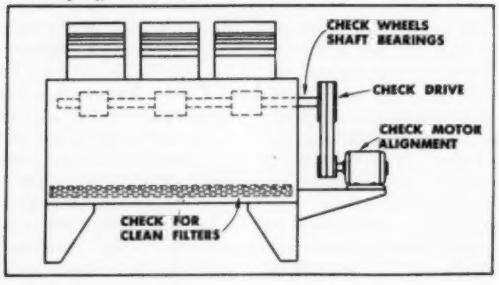
It is usually a case of economics whether or not equipment or treatment for carbon dioxide and oxygen is justified. When heating elements, return piping, and steam process equipment corrode out in less than five years, a good consulting engineer, a water treating firm, or the manufacturer of the boiler should be contacted for recommendations.

In many manufacturing plants steam is generated for processing and the condensate is wasted. Heating becomes a sideline and is usually carried on with unit heaters operating at boiler pressure varying from 100 to 150 psi. In such installations and in other high pressure installations, it is well to consider the use of reducing valves to lower the pressure below 10 psi.

Temperature acts as a catalyst with corrosion and it has been shown that the corrosion rate in a given system doubles for each 10 F temperature rise above 265 F.

Vent the unit heaters. Use adequately sized traps and water legs. Make sure that the condensate drains quickly and completely. If some remains in the heating element, capacity is reduced, corrosion may occur, and there may be damage from water hammer. Freezing with attendant failure may occur when the unit is not in operation.

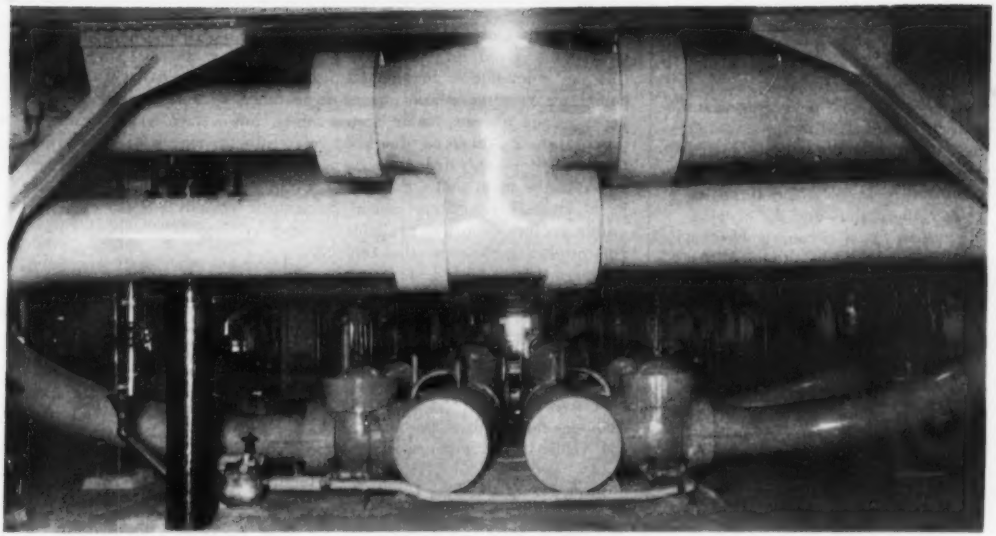
ON BLOWER TYPE UNIT heaters, attention must be given also to the fan shaft bearings, motor, and the coupling or belt drive



287 PERCENT GAS USE GAIN SINCE 1935

PER CAPITA USE OF GAS in the U. S. has increased 287 percent since 1935, it was revealed at the Mid-West Gas Association's annual meeting in Minneapolis last month.

H. Leigh Whitelaw, managing director of the Gas Appliance Manufacturers Association, ascribed the gas industry's growth to "epic feats of private enterprise."



How To Design Steam Piping for Maximum Capacity and High Pressure Drop

By Max W. Benjamin
Vice President, Boddy-Benjamin Associates, Inc.
Architects and Engineers

In his discussion of figuring large pressure drops in steam piping in the April HPAC, Ben Briskin referred to an article which appeared some time ago in HPAC for a comprehensive explanation of the limitation of maximum possible pressure drop by the acoustic velocity. This article has been out-of-print for several years, and the information is not easily available elsewhere. It has thus been reviewed and is published here . . . . . Mr. Briskin's April article was inspired by work in the Boddy-Benjamin office and his method has been applied to numerous piping designs. His article makes it unnecessary to arbitrarily divide a long pipe line into lengths for the calculation of the pressure drops (as is done in the present article)

As DISTINGUISHED from the cases commonly met in the calculation of pressure losses in piping, engineers are sometimes called upon to solve a steam flow problem involving the well established but seldom encountered phenomenon of acoustic velocity in the flow of elastic media.

While the fundamentals underlying such cases can be found in many books on physics and thermodynamics, it is believed that their application to piping problems has not been brought sufficiently to the attention of piping designers. It is the purpose here to point out the limitation which this natural phenomenon imposes on the capacity of a pipe line and to illustrate how it may be dealt with when encountered.

Where Acoustic Velocity Limit Occurs

There are at least two classes of service in which the acoustic velocity limit may occur:

1) Where a large pressure drop is available which may be utilized in selecting the minimum size of line needed for a given capacity.

2) Where the fluid is flowing at very

low pressures so that the pressure loss is quite large relative to the static pressure in the line.

An example of the first case would be a central heating system where a relatively short line feeds a constant pressure steam distribution network from boilers at considerably higher pressure. At partial loads it would be necessary to do some throttling between the boilers and the distribution system but it is conceivable that the pipe size could be so chosen that at full load all the desired pressure loss would occur in the piping itself.

An example of the second case would be the exhaust steam piping between a turbine and a condenser situated some distance away. Other examples probably will occur to the reader, depending upon his particular field of experience.

Restricted Application of Usual Formulas

In all formulas for pipe friction, the pressure loss for turbulent flow is some function of the quantity of flow raised to about the second power multiplied by the length of the line. For a given pressure loss, therefore, the rate of flow increases as the length of line decreases, and in the extreme the flow would become infinite if the length of line were reduced to zero.

Infinite flow would, of course, mean infinite velocity. Actually, with all expansive fluids — such as steam and air — the velocity of flow in a conduit of uniform cross-sectional area cannot exceed the acoustic velocity, which is the velocity of sound in the particular fluid at the pressure condition involved. Furthermore, there must be sufficient available energy between the initial and final pressure to produce the necessary increase in velocity.

If an experiment be carried out in which steam at high pressure is allowed to flow through a short pipe into a region of lower pressure, as illustrated in Fig. 1, the following pressure conditions can be observed. With the valve in the exhaust line closed, gages *A*, *B*, and *C* all indicate the same pressure. When the valve is opened slightly, a relatively small flow of steam takes place. Pressure *A* remains constant, but pressures *B* and *C* both fall somewhat and are equal to each other. As the valve is opened to permit still greater flows, pressures *B* and *C* fall still more and again remain equal until a point is reached where their value is about 58 percent of pressure *A*.

As the valve is again opened further, pressure *C* drops still lower but pressure *B* remains at 58 percent of pressure *A*. Furthermore, if the steam flowing through the apparatus had been condensed and weighed during the experiment, it would be found that as the valve is opened more and more from its closed position, the rate of flow would increase until pressures *B* and *C* had dropped to 58 percent of pressure *A*, and that further opening of the valve would not result in any further increase in the rate of flow. If the steam velocity in the short pipe is computed for

FIG. 1—ILLUSTRATING DESCRIPTION of behavior of gases and vapors having adiabatic exponent greater than unity

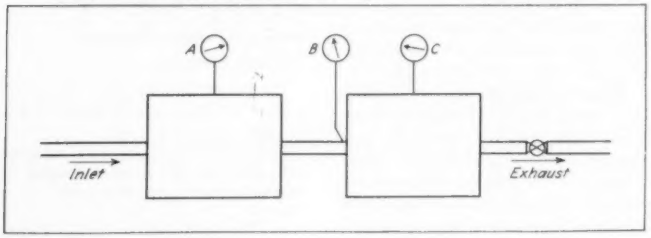


TABLE 1—ADIABATIC EXPONENTS for gases and vapors

Substance	Adiabatic exponent, k
Acetylene	1.28
Air	1.4
Ammonia	1.31
Argon	1.66
Carbon dioxide	1.31
Carbon monoxide	1.41
Ethylene	1.20
Helium	1.66
Hydrochloric acid	1.40
Hydrogen	1.40
Methane	1.32
Methyl chloride	1.20
Nitric oxide	1.40
Nitrogen	1.40
Nitrous oxide	1.26
Oxygen	1.40
Saturated steam	1.13
Sulphur dioxide	1.25
Superheated steam	1.30

An example of the use of the information given in this article was the computation of the exhaust line required for an emergency steam driven boiler feed pump turbine which on the few occasions it is operated exhausts either to the main unit condenser or to atmosphere. Since considerable presure drop was available for producing flow to the condenser, using as high a steam velocity as possible so as to keep the pipe diameter small was first considered. On investigation, however, it was found that not all of the available pressure drop could be converted into speed within the ceiling established by the acoustical velocity. In other words, it was necessary to use a larger pipe diameter than called for on a pressure drop basis, merely because the steam could not be made to travel faster than the acoustical velocity.

There are certain instances in piping design where it is possible to take advantage of a large available pressure drop to reduce the size of line required. An example of this is the case of central heating system feeders. Such lines, however, must be designed carefully so as not to reduce the size to an extent which would require velocities in excess of the acoustic velocity for the expected capacity.

There are other cases where the acoustic velocity will be obtained irrespective of any practicable size which may be chosen for the installation. Such a case is a steam exhaust line connected to a condenser at very low absolute pressure. The pressure loss will vary with the pipe size, however, and the calculation of the drop is rather different for such a case than for the usual pipe line.

Mr. Benjamin's article calls attention to the limitations of velocity for elastic fluids. The example and the graphs help to visualize the effects of acoustic velocity on capacity.

the maximum flow, it will be found equal to the velocity of sound in steam at pressure *B*.

The performance just described is typical of the natural behavior of all gases and vapors which have an "adiabatic exponent" greater than unity. Table 1 gives the adiabatic exponents for a number of gases and vapors. These exponents are used to calculate the acoustic velocity as explained in Step 2 of the sample problem given later, and may also be used to determine the ratio of the critical to the initial pressure as

$$\left[\frac{2}{n+1}\right]^{\frac{n}{n-1}}$$

The lower 58 (for steam) percent of the available pressure drop may be used to obtain velocities higher than the velocity of sound if a divergent section is attached beyond the point where the velocity of sound is attained. It is the nature of these elastic fluids that the specific volume increases faster than the velocity at all velocities above the acoustic. If the conduit is not shaped to provide for this volume expansion, the accelerated increase in volume cannot take place and therefore any increase in velocity beyond the velocity of sound is not possible. It should be noted, too, that the addition of a divergent section does not increase the capacity of the line, but merely permits the utilization of the lower range of pressure drop for the production of additional velocity at a greater specific volume.

The phenomenon described in the imaginary experiment is discussed mathematically in Loewenstein's translation of Stodola's *Steam and Gas Turbines*, Vol. I, p. 61, in Emswiler's *Thermodynamics* and in many other text books on physics and thermodynamics.

In wind tunnels designed for air velocities exceeding the acoustic, recognition of the fact that velocities exceeding that of sound could not be obtained in a conduit of uniform cross-sectional area has led the designers to provide divergent nozzles ahead of the "super-sound-velocity" sections.

Steam turbine nozzles very often have a divergent section so as to utilize effectively the available energy of the steam.

In any case of a conduit having uniform size, the possibility of

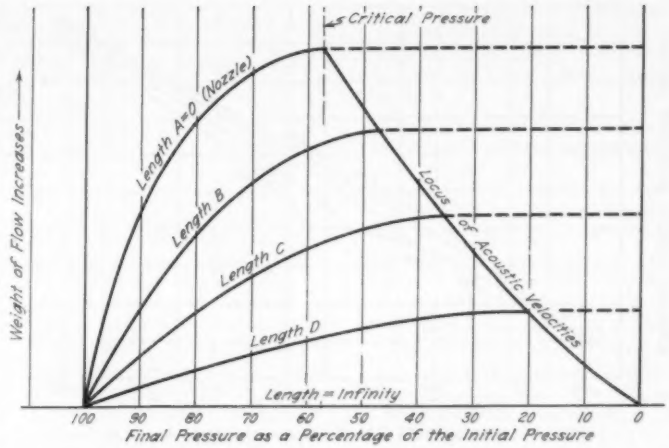


FIG. 2—RELATIONSHIPS BETWEEN pressure drop, length of pipe line, and weight of flow for steam

The length of pipe line increases in the alphabetical order given — that is, length *D* is the longest line shown. It will be noted that in the case of a nozzle the weight of flow does not increase after the final pressure has dropped to the critical pressure, which is 58 percent of the initial pressure. With a finite length of piping, the weight of flow at all final pressures is less than with a nozzle because of friction losses, and the acoustic velocity is not reached until the pressure has dropped below the critical pressure. In any case, however, the weight of flow cannot exceed the weight corresponding to the acoustic velocity. Higher velocities may be obtained by the use of a diverging nozzle or increasing cross-section beyond the point where acoustic velocity occurs, but this of course cannot increase the weight of fluid flowing through the section where the acoustic velocity exists

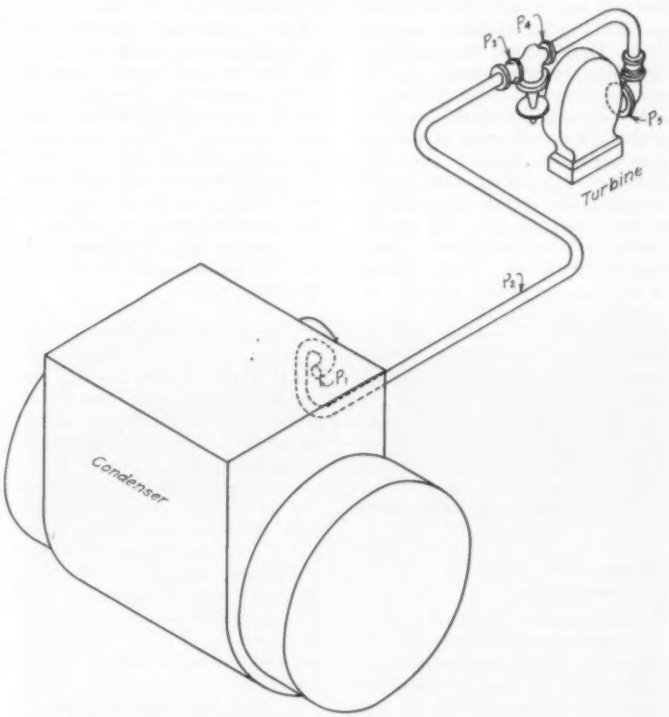


FIG. 3—EXHAUST LINE from small turbine to surface condenser used in sample problem calculated in text

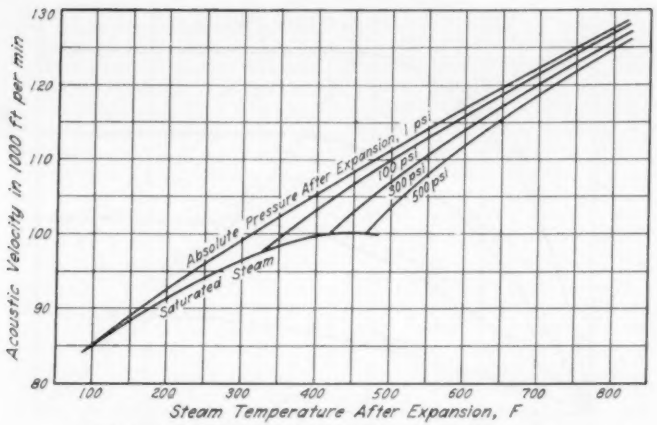


FIG. 4—APPROXIMATE VALUES of acoustic velocity for steam

acoustic velocity is indicated if the final pressure is less than 58 percent of the initial pressure for steam, or 53 percent for air. These are the pressure ratios which denote the critical pressure and hence determine the acoustic velocity in properly proportioned short nozzles.

The actual final velocity in a pipe line will depend upon friction losses as well as the available pressure drop. Fig. 2 shows the general relationship between length of line, pressure drop and weight of flow.

For cases in which the available pressure drop and length of line are known, the flow should be computed in the ordinary way by some suitable formula. The velocity coresponding to the calculated flow and specific volume at the final pressure may then be determined. If this velocity is less than the acoustic velocity, the calculated flow probably is as nearly correct as can be computed. On the other hand, if the calculated velocity exceeds the acoustic velocity, the computed flow is too high and the correct flow will be that corresponding to the acoustic velocity. For any set of conditions the acoustic velocity may be computed as shown in Step 2 of the outline of procedure given below.

Design of an Exhaust Line

The solution of an actual problem for a low pressure exhaust line will clarify the foregoing discussion as well as show in detail the procedure necessary for determining the pipe size in this real case.

The piping under consideration connects the exhaust of a small turbine to a surface condenser, Fig. 3. The condenser pressure is known and the equivalent length of pipe line and approximate steam flow are known. It is desired to determine the absolute pressure at the exhaust of the turbine for different sizes of exhaust piping so as to select the most suitable pipe diameter.

With a condenser pressure of 1 in. Hg absolute, it is practically certain that the final pressure (that is, at the condenser end) will be less than 58 percent of the initial pressure (turbine end) since that would make the initial pressure only $1 \div 0.58 = 1.72$ in. Hg absolute and would allow only 0.72 in. Hg for friction loss. The procedure then is as follows:

1) Assume a pipe diameter and, from the piping layout, calculate the equivalent length.

2) Assume an appropriate value of acoustic velocity for first trials or estimate it by means of the formula below, using values of P and V that are thought to be about right. After the final pressure is determined this can be checked by the formula, acoustic velocity in fpm $= 60\ (gn\ PV)^{1/2}$, where g is gravitational acceleration in ft per sec per sec; n is the adiabatic exponent, which equals about 1.13 for saturated steam and 1.3 for superheated steam; P is the final absolute pressure in lb per sq ft; and V is the specific volume in cu ft per lb at pressure P. Fig. 4 shows approximate values of acoustic velocity for steam.

3) With the approximate rate of flow, pipe size, and velocity known, the specific volume at the pipe end can be computed as: Specific volume = (pipe area × acoustic velocity)/(flow in lb per sec × 60).

4) Determine enthalpy of steam at the pipe end as: Enthalpy at turbine exhaust — [(acoustic velocity)/(223.7 × 60)]^2.

5) From the enthalpy and specific volume determine the absolute pressure by use of the steam tables.

6) With the pressure and specific volume available, check the acoustic velocity assumed in Step 2 and if necessary redetermine the specific volume and pressure as in 3, 4, and 5.

7) When a satisfactory estimate of specific volume and pressure at the low pressure end has been obtained, these values may be used in a suitable formula for pressure loss, computing pressure losses for short lengths of pipe and proceeding upstream toward the turbine. The specific volume used in the pressure drop formula should be an average value for the particular section of pipe being computed and should be altered in successive trials until the average of the specific volumes at the two ends of the section checks the value used in the formula.

Sample Solution

For the case under consideration, the following data are available:

Steam flow = 27,400 lb per hr = 7.61 lb per sec.

Enthalpy at turbine exhaust = 1311.2 Btu per lb.

Condenser pressure = 1 in. Hg abs.

Equivalent length of exhaust piping as follows:

12 in. diam, equivalent length = 322 ft.
14 in. diam, equivalent length = 360 ft.
16 in. diam, equivalent length = 420 ft.
18 in. diam, equivalent length = 480 ft.

The problem is to determine the absolute pressure at the turbine exhaust flange for the different pipe sizes in order to select the most suitable diameter.

The solution for the 12 in. size as outlined above is:

1) Assume 12 in. pipe, 322 ft equivalent length.

2) Assume acoustic velocity = 108,000 fpm at the condenser end.

3) Specific volume = (0.7854 × 108,000)/(7.61 × 60) = 186 cu ft per lb.

4) Enthalpy at pipe end = 1311.2 — [108,000/(223.7 × 60)]^2 = 1246.5 Btu per lb.

5) Pressure corresponding to 186 cu ft per lb and 1246.5 Btu per lb = 2.85 psi absolute = p_1.

6) Check on acoustic velocity as-

TABLE 2

Pipe size in.	Equivalent length, ft	Steam velocity, fpm: Turbine end	Steam velocity, fpm: condenser end	Vacuum, in. Hg: At turbine	Vacuum, in. Hg: At condenser	Vacuum, in. Hg: Inside condenser
12	322	39,800	107,380	14.3	24.2	29.0
14	360	39,100	107,800	16.9	25.2	29.0
16	420	38,700	106,800	20.1	26.5	29.0
18	480	38,700	106,900	22.3	27.2	29.0

sumed in (2): Acoustic velocity = 60 (32.2 × 1.3 × 2.85 × 144 × 186)½ = 107,400 fpm.

This is considered a satisfactorily close check on the value of 108,000 assumed in (2) especially in view of the fact that the adiabatic exponent is not exactly constant.

7) Since this is a rather large line carrying steam at high velocity, Fritzsche's formula for pressure loss should be used. This formula is $p = (0.8\ LF^{1.85} \times \text{specific volume})/d^{4.97}$, where p is the pressure drop in lb per sq in., L is the equivalent length of pipe in ft, F is the steam flow in lb per sec, d is the inside pipe diameter in inches.

Assume the line to be divided into four lengths of 322/4 = 80.5 ft each. Then $p = [(0.8 \times 80.5 \times 7.61^{1.85})/12.00^{4.97}] \times \text{specific volume} = 0.0119 \times \text{specific volume}$.

The specific volume to be used is the average value in each section of the line. By the method of successive trials this is found to be 150 for the section of line nearest the condenser.

Then $p = 0.0119 \times 150 = 1.79$ psi.

$p_2 = p_1 + p = 2.85 + 1.79 = 4.64$ psi.

Specific volume at $p_2 = 114$.

Average specific volume = (186 + 114) /2 = 150.

For the next section

$p = 0.0119 \times 102 = 1.21$ psi.

$p_3 = p_2 + p = 4.64 + 1.21 = 5.85$ psi.

Specific volume at $p_3 = 90$.

Average specific volume = (114 + 90)/2 = 102.

For the next section

$p = 0.0119 \times 85 = 1.01$ psi.

$p_4 = p_3 + p = 5.85 + 1.01 = 6.86$ psi.

Specific volume at $p_4 = 77$.

Average specific volume = (90 + 77)/2 = 84.

For the section nearest the turbine

$p = 0.0119 \times 73 = 0.87$ psi.

$p_5 = p_4 + p = 6.86 + 0.87 = 7.73$ psi.

Specific volume at $p_5 = 69$.

Average specific volume = (77 + 69) /2 = 73.

The absolute pressure at the turbine exhaust flange therefore is 7.73 psi and the vacuum will be 30 — (7.73/0.491) = 14.3 in. Hg.

Notice too that the absolute pressure at the condenser end of the line is considerably higher than the pressure in the condenser itself. Similar solutions are completed for the other pipe sizes considered, and for this particular case gave the results shown in Table 2.

While the vacuum at the turbine improves as the pipe size increases it is interesting to note that the velocities at the two ends of the line remain substantially the same irrespective of size. The reason is, of course, that with lower absolute pressures in the larger lines the specific volumes are greater — with the result that the steam velocity changes but little.

As far as steam carrying capacity is concerned, there is no reason why even smaller lines should not be studied for this installation. Other considerations are involved, however, such as the effect of increasing back pressure on the economy of the turbine, etc. In this case the 12 in. size was selected.

While the phenomenon of acoustic velocity will not often be involved in piping design it is important that it be recognized and taken into account wherever it is encountered. A knowledge of this phase of fluid flow may permit the use of smaller lines than would otherwise be selected in some cases, and in any event it will enable the designer to determine the limiting capacity of a given size of line where a large available pressure drop is to be utilized in causing flow.

SNOW MELTING FOR SCHOOL'S PLAYGROUND

ONE OF THE FIRST schools in the country to incorporate snow melting facilities in an outdoor playground area is the Dayton St. school, Newark, N. J. The 6000 sq ft courtyard will be kept free of snow and ice by wrought iron heating grids placed below the surface. The piping is 1 in., spaced on 15 in. centers.

Advantages of the system are fourfold: (1) Colds should be reduced, as wet snow underfoot is eliminated. (2) It does away with accidents caused by children pushing out of the building on slippery days. (3) The number of play days is increased, since the system keeps the courtyard clear and dry. (4) Corridors and rooms of the school are expected to be kept cleaner when children enter by way of the play area on snowy, slushy days.

OUTDOOR PLAYGROUND area at Newark school has snow melting

Mechanic's Lien Legalities Are Sometimes Tricky

MECHANIC'S LIENS are excellent sources of protection, provided that the technicalities — including those of "listing" — are properly conformable to law.

The trick lies in a clear understanding of the difference between a "subcontractor" and a "material man". A recent case (names here disguised) shows how you can lose your lien and your money by ignoring such fine distinctions.

Pyper, Inc., was a subcontractor under Hiho Construction Co., the general contractor on a job for the Freehold Co., which job required (among other things) a 700 gal tank. Hiho abandoned the work before installation was completed. Pyper had bought the tank from a manufacturer trading as Indo Equipment, who had delivered it in three sections plus a cover and who had his own men put the tank together on the premises of the Freehold Co. The sections were "set" and cemented together with cement mixed on the premises by Indo's employees, and those employees placed it in position.

Half the purchase price of the tank remained unpaid when Hiho disappeared from the scene. Pyper thereupon filed a mechanic's lien on the real estate and brought suit to foreclose. He asked that the property be sold and the proceeds applied to the payment of the various liens in the order of their priority.

Defendant Freehold admitted most of the alleged facts but claimed that they did not "constitute a cause of action".

Upholding this view, the court of common pleas of the state laid down the general rule that, before a valid mechanic's lien can be established, there must be a *strict compliance* "with the definite procedural requirements" imposed by statute. Even though the mechanic's lien law be

liberally construed as a remedy, said the court (citing from former decisions), "the steps prescribed by statute to perfect such lien must be followed, and in that respect the law is strictly construed and applied."

Under the statute, which the decision quotes in part, the original (general) contractor, before drawing any money, must furnish a sworn statement. This statement should show the name of every subcontractor in his employ "and of every person furnishing machinery, material or fuel, with amount . . . for work done or machinery, material or fuel furnished . . . which statement shall be accompanied by a certificate signed" by every such person. "The original contractor shall deliver" to the owner, part owner, lessee or mortgagee "similar sworn statements from each subcontractor, accompanied by like certificates from every person furnishing material or fuel to such subcontractor."

Until these statements are made and furnished in the *manner* and *form* provided by statute, neither the contractor nor the subcontractor shall have any right of action or lien against the owner, says the law.

In this case the manufacturer, Indo Equipment, was listed by subcontractor Pyper as a *material man*. The owner Freehold, on the other hand, contended that Indo was not a material man but a *subcontractor*, and as such was required to give certain affidavits as set forth in the statute. By reason of Indo's failure to do so, said the owner, the mechanic's lien was "void and of no effect".

Material Man or Subcontractor?

As viewed by the court, this case hinged on the question: Was Indo a material man or a subcontractor? And if he was a subcontractor, had the plaintiff Pyper complied with the mechanic's lien law in order to obtain a good lien on the real estate of Freehold?

The court takes cognizance of a very fine distinction between a material man and a subcontractor. Their respective duties differ. Material men give *certificates*, whereas subcontractors are required to submit *affidavits* similar to that of the original contractor. The words "material man" are defined as including "all persons by whom any machinery, materials or fuel are furnished in or for any construction, erection, alteration, repair, or removal . . . upon which the improvements contemplated . . . are made."

The word "subcontractor" is defined by the statute as "any person, firm, or corporation who undertakes to construct, alter, erect, improve, repair, remove, dig or drill any part of the structures . . . under a contract with any person other than the owner."

From these definitions, it follows that if a person *merely furnishes material* and furnishes *no labor on the premises* where the work is carried on, then he is a "material man". On the other hand, it appears that one who not only furnishes material but also *does* any *work* or labor *on the premises*, either personally or by his employees, is a "subcontractor". However, if he assembles the material in his own factory (or furnishes raw material without fabrication), takes no part in on-the-job fabrication or installation but merely sells and delivers the material either raw or fabricated, that person is not a contrac-

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

tor or subcontractor but is a *material man* only. It's not the labor used in *manufacture*, but the labor used in *installation* which converts the otherwise material man into a subcontractor.

In our Pyper case the manufacturer, Indo Equipment, brought the tank to Freehold's property in four sections because of its great weight and installed it there, using two of his laborers on the premises in fitting and cementing the sections together. This course of action made him a subcontractor, in the opinion of the court.

"Mere Legal Quillets"?

Instead of dismissing these nice distinctions as mere legal quillets, we may well give ear to the warning of the judge as quoted in an above paragraph, emphasizing *strict* compliance with the law.

Pyper lost his lien because he failed to inform himself thoroughly as to the difference between a contractor (or subcontractor) and a material man — doubtless deeming the status of other parties unimportant so long as his own was not subject to question.

He argued in vain that if Indo were a subcontractor and assembled the tank on the site, all of Indo's employees at his plant in another city would be entitled to perfect a lien on Freehold premises. Rejecting this view as leading to "absurd consequences", the court cited a previous decision and enounced that employees of a factory where part of a job is fabricated have no right of lien upon the premises where the fabricated material has been delivered and used, unless such employees "performed some labor" upon those premises.

Accordingly, the court found that when Pyper in his affidavit listed Indo as a "material man" he did not comply with the mechanic's lien law of the state. Therefore, ruled the court, his "purported" mechanic's lien was not good, and his petition was dismissed.

Mechanic's lien laws may vary in different states, but the principle here exemplified remains the same. Such statutes are, say the courts, "in derogation of the common law" and for that reason their necessarily strict construction presents technical pitfalls that are tricky in the extreme.

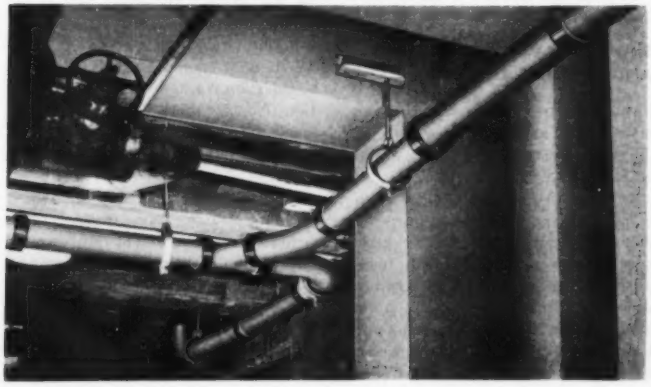
[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

Overhead Clay Piping Used At Heating Plant

RECENTLY-INSTALLED overhead clay pipe lines at the Beech St. heating plant of the Ohio Edison Co., Akron, are suspended from the 15 ft ceiling of a basement room in the steam heating plant. The hangers are installed at 3 ft intervals.

The ceramic pipe is resistant to corrosive chemicals. In this particular installation, it must regularly carry a 3 percent solution of sulphuric acid and an almost saturated solution of brine, and at times must withstand a 4 ft head.

THE PIPE, RESISTANT to corrosive chemicals, is suspended from the 15 ft ceiling by hangers at 3 ft intervals



Threads were removed at the pipe ends which made contact with the floor drain above. At this point, jute was rammed around the outer diameter of the pipe and the floor. Acid-proof cement was then troweled into the opening to complete the job.

Use was made of one pressure molded type union in the form of a split flange bolted together at the sides. This device, which was required on the last hookup, facilitates assembly when connections such as elbows, T's and Y's are necessary in the line, or in any situation where space limitations prevent screwing the next pipe length into the collar.

At all other locations on the installation, a joint combining plastic with vitrified clay was utilized. To assemble this joint, the pressure molded plastic collar was threaded over the stationary clay pipe end, and the pipe to be added to the line was turned into the collar by hand. This operation was accomplished quickly through three complete revolutions of the pipe by hand and a fourth and final turn with a strap wrench.—W. W. EVANS, Development Engineer, The Robinson Clay Product Co.

STUDY NICKEL CONSERVATION IN ALLOY CASTINGS

CONSERVATION of nickel and chromium in heat resistant castings is the objective of important research announced by the Alloy Casting Institute, of Mineola, N.Y. Conducted at the Battelle Memorial Institute, the study has been concentrated on developing a heat resistant material of lower alloy content than the high nickel alloys frequently used in 900-1400 F service.

From knowledge of the iron-chromium-nickel alloy system and field experience, casting metallurgists selected an alloy containing 21 percent chromium and 9 percent nickel, designated as the "HF" type, as the material most likely to provide the combination of strength and corrosion resistance required for "intermediate temperature" (900-1400 F) service. Tests to date indicate that this alloy offers a promising solution to the requirements of such service, says the institute.

Duct Design, Grille Choice Questions Are Answered

A MECHANICAL ENGINEER asked several questions regarding air flow and duct design, which were published in the March Question of the Month pages:

"The duct in Fig. 1 is designed by the 'equal friction' method, so that the friction loss per foot is constant throughout its length, for the volumes of air flow indicated.

"By 'normal pressure', I mean pressure normal to the face of a grille or other opening provided for letting air out of a duct. This may be the static pressure in the duct, the total pressure in the duct, or the static pressure plus a part of the velocity pressure, depending upon how much of the velocity pressure is utilized in pushing the air out of the opening.

"*Question No.* 1—Must opening *A* be of a definite size, for 200 cfm, a variation from which would cause more or less than 200 cfm to flow out of it, and *less* or *more* than 800 cfm to flow in the second section of duct?

"*Question No.* 2—Upon the sudden 90 deg change in direction of the 200-cfm-portion of air coming out of the opening, is all of the velocity pressure it had when flowing in the first section of the duct, lost in the shock of the directional change?

"*Question No.* 3—Is any of its former velocity pressure recovered so as to increase the pressure behind the opening (normal pressure), as would be the case if the air had been turned by means of an elbow or other turning device?

"*Question No.* 4—If any of its former velocity pressure is recovered, what percent (approximately)?

"*Question No.* 5—Is the velocity pressure in the air stream, just outside of the opening, equal to the normal pressure inside the opening minus the friction loss through the opening?

"*Question No.* 6—Is this friction loss relatively small, or, in other words, is the normal pressure inside almost entirely converted into velocity pressure when the air flows out of the opening?

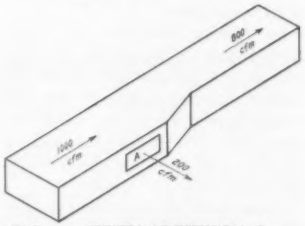


FIG. 1 — SEVEN QUESTIONS about air flow in this duct and from the outlet are asked by a mechanical engineer and are commented on by several readers in reply

"*Question No.* 7—In manufacturers' grille selection tables, a certain 'pressure required behind the grille' is given for a certain size of grille, a certain volume of air flow through the grille, and a certain throw. Must this pressure, as given in the tables, be the same as that which actually exists in the duct behind the grille (normal to the face of the grille) to get the volume of flow and throw from that particular grille, as shown in the tables?"

Several of HPAC's readers have prepared answers:

SHOULD HAVE DAMPER AND TURNING DEVICE

REPLYING TO THE questions on air distribution asked on page 107 of the March issue, we desire to advise as follows:

Question No. 1—The size of opening *A* is, for all practical purposes, determined by the size of the grille necessary to handle 200 cfm for a given throw and a given terminal velocity. The static pressure in the duct system at various points may be such as to cause a greater or lesser quantity than 200 cfm to flow through the branch duct and the grille. Therefore, a damper must be used to correct the total pressure existing behind the grille to that which will cause just 200 cfm to pass through its effective area. Therefore, any grille installation should have a damper attachment in addition to the grille face in order to perform this function. It is practically impossible to design a static regain system with sufficient accuracy so as to have exactly the total pressure required for a given grille size, a given cfm and to produce a given throw existing in the main duct.

Question No. 2—In general, with a 90 deg change in direction for the 200 cfm portion of the air from the main into the branch, one velocity head is lost since static pressure is the only force available to turn air at right angles.

Question No. 3—None of the former velocity pressure is recovered without a turning device.

Question No. 4—None.

Question No. 5—The velocity of the air stream in the vena contractas existing between each of the grille bars is equal to the total pressure existing directly behind the grille. In other words, there is approximately 100 percent conversion of the total energy existing in the air stream back of the grille into velocity energy in the points of the vena contracta. Obviously, if a very minute pitot tube is used and a delicate traverse made, it will be found that there is some friction loss afforded by the contact of air with the bars of the grille. However, this is so small that with an ordinary laboratory pitot tube and manometer combination, it cannot be detected.

Question No. 6—As stated in question No. 5, there is an extremely small amount of loss due to friction as air contacts the blades of the grille.

Question No. 7—There are many ways of listing "pressures required behind the grille". The pressure in which the designer is most interested is the total pressure existing behind the grille for a given flow because this determines the velocity of air in the vena contractas, and is related to the final throw. However, some

manufacturers may rate their grilles in terms of "static pressure required behind the grille". In order to arrive at the maximum velocity in the vena contractas, it is then necessary to add the velocity head of the air in the branch duct so as to arrive at total pressure. This total pressure as a static pressure equivalent to this total pressure, is then added to the total duct system friction for the longest equivalent run because as we have said if one velocity head is lost in making the turn from a main into a branch, then the static pressure existing at the point of branch take-off must be equal to or greater than the total pressure required in the jets of the grille.

We trust that these comments will be of interest in answering these questions.—R. D. T.

WILL HEAT DRY OUT SOIL AND CAUSE PIPE OR SLAB TO SETTLE?

If you don't have the answer to one of your problems, chances are someone else does — or can be helpful on part of it. That's the purpose of this "idea exchange" in each issue, where questions on heating, piping and air conditioning are asked and answered.

You are invited to contribute a question for publication, or an answer to a published question. . . . . Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Here is a question asked by an engineer about a perimeter heating system. Can you help him out?

"We have designed a warm air perimeter heating system for a one floor structure of rather large size, using clay pipe for distributing the warm air from a heater room in the center of the building.

"Our structural engineers have raised a point on which I am seeking information. They ask if there would be any possibility of the heat from the clay pipe runs drying out the soil to the extent that settling of the clay pipe or of the floor slab itself might occur.

"Any comment on whether or not this point needs particular consideration, and any experience with other installations of this type, would be most helpful."

EQUATIONS DEVELOPED TO ANSWER QUESTIONS

ANSWERING THE questions on air flow and duct design published in March, it is my opinion that it is static pressure that pushes air through an opening perpendicular to the side (or the top or bottom) of a duct. The total pressure and velocity pressure in the duct affect the quantity of air through the opening only as they affect the static pressure in the duct. Of course we know that air does not always come out an opening in the side of a duct, just because an opening has been provided, for—if the velocity pressure is high enough inside the duct —the static pressure will be lower inside the duct than outside, and air will be pushed through the opening into the duct.

In answer to *Question No.* 1, it seems, therefore, that the opening A must be of a definite size to have 200 cfm leave the main duct, and further, that the velocity in the main duct must be known.

Question No. 2—As for the velocity pressure being "lost" in going through the opening, I would say that yes, it is.

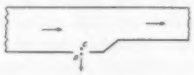


FIG. 2 — "F.M." DEVELOPS several equations in reply to the questions. This top view of a trunk duct shows the points C and D to which he refers

If we let C be a point just inside the opening (Fig. 2) we can write the basic equation that the total pressure at C is equal to the static pressure at C plus the velocity pressure at C:

$$h_{tC} = h_{sC} + h_{vC} \quad \ldots\ldots\ldots\ldots [1]$$

Likewise at a point D, just outside the opening in Fig. 2:

$$h_{tD} = h_{sD} + h_{vD} \quad \ldots\ldots\ldots\ldots [2]$$

The static pressure at C is what pushes the air through the opening and is, therefore, equal to the total pressure at D. Thus

$$h_{sC} = h_{tD} \quad \ldots\ldots\ldots\ldots [3]$$

Now the static pressure from Equation 2 is equal to the friction through the opening from C to D, so we may write

$$h_{tD} = h_{fC\text{-}D} + h_{vD} \quad \ldots\ldots\ldots\ldots [4]$$

Using Equation 3 we may write Equation 4 as:

$$h_{sC} = h_{fC\text{-}D} + h_{vD} \quad \ldots\ldots\ldots\ldots [5]$$

Since open holes in exposed ductwork are not aesthetically acceptable, the usual solution is to fasten a flush grille over the opening. This also results in better diffusion of the air stream and may, depending upon the style of the grille, offer directional control. The resistance offered by the grille is the friction term in Equations 4 and 5.

If we solve Equations 4 and 5 for velocity pressure,

$$h_{vD} = h_{tD} - h_{fC\text{-}D} \quad \ldots\ldots\ldots\ldots [6]$$

$$h_{vD} = h_{sC} - h_{fC\text{-}D} \quad \ldots\ldots\ldots\ldots [7]$$

we observe that the velocity pressure at D bears no relation whatever to the velocity of the air in the duct.

Question No. 3—For the flush opening there is no recovery of velocity pressure. If an elbow, splitter, turning vane or some other device is used, the problem is completely changed.

Question No. 5—If the normal pressure inside the opening is equal to the static pressure inside the opening, then Equation 7 answers this question as yes.

Question No. 6—If this question can be written, "Is this friction loss relatively small?", I would say yes. It must be kept in mind, however, that the friction term in Equation 7 depends upon the quantity of air flowing, the area of the grille, the percentage of free opening, and the aspect ratio.

Question No. 7—Yes, most manufacturers mean the static pressure at a point just inside the opening, which was designated as C in developing the equations above.—F. M.

SUGGESTION AWARDS A RECORD HIGH

A RECORD HIGH of more than $\$1\frac{1}{2}$ million dollars was awarded to employees of the General Electric Co. and its affiliates for useful suggestions during 1951 under the company's suggestion award program.

DATA SHEET

How To Assemble and Maintain Flanged Piping Joints

WHEN A FLANGED joint is assembled, each of the component parts is subjected to tensile or compressive stresses of varying magnitude. Under service conditions, especially where high temperatures are involved, a change in the magnitude of these stresses occurs and a lowering of the bolt stress results.

To compensate for this reduction in bolt stress, the following recommendations are made with regard to the assembly and maintenance of flanged joints.

Applying the Initial Bolt Stresses

Initial bolt stresses to be applied in the assembly should afford a reasonable factor of safety with reference to the yield point of the bolting material. And yet the initial bolt stress must be high enough to insure a tight joint.

An extensive survey of field erected flanged joints has indicated the initial stresses that are usually applied when alloy steel bolt studs are pulled up manually. Experience has shown that these stresses are satisfactory for American Standard Steel Flanges and will comply with the requirements as set forth in the preceding paragraph.

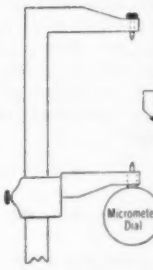


FIG. 1 — INSTRUMENT FOR measuring bolt stud elongation

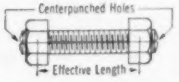


FIG. 2 — PREPARATION OF ENDS of a bolt stud for accurate measurement

The values given in Table 1 have been graduated according to size — however, if it is possible to apply higher torques, it is recommended that the initial bolt stress be approximately 45,000 lb per sq in.

The initial bolt stress can be applied by either of two methods: (1) By pulling up the well lubricated bolt studs with the proper torque, or (2) by pulling up the bolt studs to produce the elongation necessary for the desired bolt stress.

When the second method is used the total desired elongation of the bolt stud should be ascertained by multiplying the value given in the table for elongation in inches per inch by the effective length (distance from center of one nut to center of the other).

Figs. 1 and 2 show, respectively, the design of an instrument which can be used in measuring bolt stud elongation and the preparation of the ends of a bolt stud for measurement.

When Should Bolts Be Pulled Up?

When should bolt studs be pulled up after being in service?

It is recommended that the bolting in all flanged joints installed on temperatures above 500 F be pulled up after the first shutdown. On high temperature service where creep may be expected to occur, it is recommended that the bolting be pulled up at least once during the first 200 hr of service, regardless of whether the line has been shut down or not. Bolt stress should be checked periodically during the life of the installation.

How should the bolt elongation be checked and the bolt studs pulled up?

As a general rule, it is only necessary to check the elongation in two or three diametrically opposite bolt studs, using the average of the values obtained as the elongation for the remainder. If the bolt elongation is to be determined while the joint is in service, one bolt should be checked and pulled up before another is loosened. Measurements should be taken immediately after releasing the load before the bolt temperature decreases.

The following procedure should be used in checking bolt elongation:

TABLE 1 — INITIAL STRESSES usually applied when alloy steel bolt studs are pulled up manually

Size of Alloy Steel Bolt-Stud (Note 1)	Average Stress Applied Manually Lbs. per Sq. Inch (Note 2)	Approximate Torque to Obtain Stress, Ft. Lbs. (Note 3)	Elongation in Inches, per Inch of Effective Length (Note 4)
3/4	52,000	175	.00173
7/8	48,000	255	.00160
1	45,000	370	.00150
1 1/8	42,500	500	.00142
1 1/4	40,000	665	.00133
1 3/8	38,000	860	.00127
1 1/2	36,500	975	.00122
1 5/8	35,000	1285	.00117
1 3/4	34,000	1700	.00113
1 7/8	33,000	2200	.00110
2	32,000	2350	.00107

Notes: (1) Coarse thread series, 1" and smaller; 8 pitch thread series, 1 1/4" and larger. (2) Average stress applied by maintenance men in assembly, using a lever and wrench or by sledging. (3) Based upon well-lubricated threads. (4) Based on a modulus of elasticity of 30,000,000. The effective length of bolt-stud equals the distance from center of one nut to center of the other.

TABLE 2 — DATA FOR MACHINE bolts and cold rolled steel bolt studs. (Load in pounds on bolts and bolt studs when torque loads are applied)

Nominal Diameter of Bolt	No. of Threads per Inch	Diameter at Root of Thread	Area at Root of Thread	Stress					
				7,500 Lbs. per Sq. In.		15,000 Lbs. per Sq. In.		30,000 Lbs. per Sq. In.	
				Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.
1/4"	20	.185	.027	1	203	2	405	4	810
5/16	18	.240	.045	2	388	4	675	8	1350
3/8	16	.294	.068	3	510	6	1020	12	2040
7/16	14	.345	.093	5	698	10	1395	20	2790
1/2	13	.400	.126	8	945	15	1890	30	3780
9/16	12	.454	.162	12	1215	23	2430	45	4860
5/8	11	.507	.202	15	1515	30	3030	60	6060
3/4	10	.620	.302	25	2265	50	4530	100	9060
7/8	9	.731	.419	40	3143	80	6285	160	12570
1	8	.838	.551	62	4133	123	8265	245	16530
1 1/8	7	.939	693	98	5190	195	10380	390	20760
1 1/4	7	1.064	.890	137	6675	273	13350	545	26700
1 3/8	6	1.158	1.054	183	7905	365	15810	730	31620
1 1/2	6	1.283	1.294	219	9705	437	19410	875	38820
1 5/8	5 1/2	1.389	1.515	300	11363	600	22725	1200	45450
1 3/4	5	1.490	1.744	390	13080	775	26160	1550	52320
1 7/8	5	1.615	2.049	525	15368	1050	30735	2100	61470
2	4 1/2	1.711	2.300	563	17250	1125	34500	2250	69000

TABLE 3 — DATA FOR ALLOY steel bolt studs. (Load in pounds on bolt studs when torque loads are applied)

Nominal Diameter of Stud	No. of Threads per Inch	Diameter at Root of Thread	Area at Root of Thread	Stress					
				30,000 Lbs. per Sq. In.		45,000 Lbs. per Sq. In.		60,000 Lbs. per Sq. In.	
				Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.
1/4"	20	.185	.027	4	810	6	1215	8	1620
5/16	18	.240	.045	8	1350	12	2025	16	2700
3/8	16	.294	.068	12	2040	18	3060	24	4080
7/16	14	.345	.093	20	2790	30	4185	40	5580
1/2	13	.400	.126	30	3780	45	5670	60	7560
9/16	12	.454	.162	45	4860	68	7290	90	9720
5/8	11	.507	.202	60	6060	90	9090	120	12120
3/4	10	.620	.302	100	9060	150	13590	200	18120
7/8	9	.731	.419	160	12570	240	18855	320	25140
1	8	.838	.551	245	16530	368	24795	490	33060
1 1/8	8	.963	.728	355	21840	533	32760	710	43680
1 1/4	8	1.088	.929	500	27870	750	41805	1000	55740
1 3/8	8	1.213	1.155	680	34650	1020	51975	1360	69300
1 1/2	8	1.338	1.405	800	42150	1200	63225	1600	84300
1 5/8	8	1.463	1.680	1100	50400	1650	75600	2200	100800
1 3/4	8	1.588	1.980	1500	59400	2250	89100	3000	118800
1 7/8	8	1.713	2.304	2000	69120	3000	103680	4000	138240
2	8	1.838	2.652	2200	79560	3300	119340	4400	159120
2 1/4	8	2.088	3.423	3180	102690	4770	154035	6360	205380
2 1/2	8	2.338	4.292	4400	128760	6600	193140	8800	257520
2 3/4	8	2.588	5.259	5920	157770	8880	236655	11840	315540
3	8	2.838	6.324	7720	189720	11580	284580	15440	379440

a) Determine the length of the bolt in the assembled joint.

b) Release the load on the bolt by loosening the nut and re-measure the length.

c) Subtract second reading from first.

d) Divide this value by the effective length of the bolt. (Effective length equals distance from center of one nut to center of the other.)

If the residual elongation is less than 70 percent of the values given in Table 1, the bolts should be pulled up so that the final elongation approximates the figures shown.

Torque Required to Produce Bolt Stress

The torque or turning effort required to produce a certain stress in bolting is dependent upon a number of conditions, some of which are:

1) Diameter of bolt.

2) Type and number of threads.

3) Material of bolt.

4) Condition of nut bearing surfaces.

5) Lubrication of bolt threads and nut bearing surfaces.

Many tests have been conducted to determine the relation between torque and bolt stress, from which Tables 2 and 3 were prepared. The values given in these tables are based upon steel bolting well lubricated with a heavy graphite and oil mixture, or with high temperature thread lubricant for high temperature service. It was found that a non-lubricated bolt has an efficiency of about 50 percent of a well lubricated bolt and also that different lubricants produce results varying between the limits of 50 and 100 percent of the tabulated stress figures.

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SAM LEWIS' PAGE

Practical Heating Pointers I've Run Across Recently

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems

I HAD OCCASION recently to compare the fuel consumption of two apartment buildings. Both are heated by the same type of system, and both have so many stories that the loss of heat through the roof is relatively unimportant.

Good Operation Pays Off

Building B has a remarkably efficient and intelligent engineer-custodian. Building A, unfortunately, does not.

The heat losses were computed by the same formula for both buildings. The relative area of heat transmitting surface in proportion to the heat loss in each room is the same in both buildings.

Building B, with the good custodian, required during January, 420 Btu in fuel per unit of exposed area. Building A, with the indifferent custodian, required 510 Btu. Thus, something like one-fifth of the fuel has been saved by a skillful operator. While elaborate automatic controls for temperature and combustion are present in both buildings, they cannot be depended upon to supersede human brains.

Unconventional Steam Heating System

Recently, in a hotel of old vintage in Florida, I noticed an unconventional steam heating system. This multi-story building has a radiator in each bedroom on the corridor side, parallel with the corridor wall. The single pipe steam mains serving the risers that feed these radiators are fitted tightly against the first story corridor ceilings in the corners where the ceilings join the walls.

Not any of the steam pipes are insulated and there are no evidences of provision for expansion and contraction. However, the wooden walls must come and go to cater to the movement of the pipes, for I was not disturbed each morning by the creaks and hammers that might have been expected.

"May Land On His Ear"

The convector manufacturer tries to beat the valve manufacturer by building a damper into the sheet metal enclosure of the convector, the idea being that the temperature of the room can be controlled adequately by a damper — without any valve in the pipe connection that brings steam or hot water to the convector.

I have found that some of these dampers are merely teasers, extending partly across the very gentle air stream, and that they cannot always be closed tightly.

The next salesman who suggests to me that I omit a valve on the heat supply may land on his ear on the pavement!

Reader Asks Aid on Water Hammer

A reader asks for advice on correcting water hammer in the steam pipes and blast heaters in his ventilating plant. He calls the trouble "knocking and rapping", which to my ear means the familiar habit of Nature abhorring a vacuum. He worries particularly about the noise in the gilled (or finned) copper tubes over which the fan forces relatively cool air.

Whenever heat is transferred to air from steam, some of the steam changes state back to condensate or water, and if the conditions of the steam supply in relation to the air temperature and volume are critical, a subatmospheric pressure condition can occur inside the tubes. Perhaps the steam supply pipe is too small, or perhaps the gilled tubes are not sufficiently higher than the water level in the boiler, or perhaps the pump that is supposed to return the condensate to the boiler is failing in its duty.

Anyway, a subatmospheric pressure occurs inside the rapidly cooling tubes, and water jumps up to supply the deficiency or partial vacuum. In so doing, it slaps against the tube and makes the noise.

In checking up on the cure for this problem, the following points are important:

1) Difference in level of the bottom of the gilled tubes and the water line in the boiler.

2) Is there a condensate pump?

3) Size of steam supply pipe to the gilled tubes.

4) Is there a trap on the return connection for each section of gilled tubes?

5) What arrangements exist for eliminating the air from the interior of the steam piping and from the gilled tubes? This means are there adequate automatic or manual air valves?

6) It must be remembered that sometimes the water hammer occurs in steam or return mains in which drainage is imperfect, the fault sometimes being due to settlement of the building or to failure of pipe hangers to maintain the important drainage pitch.

7) Noises from water hammer sometimes occur if the steam supply valve is throttled, either by a valve that responds to a thermostat or by manual intervention.

In one large institution having several buildings heated from a central boiler plant and having extensive underground steam and condensate piping, the knocking occurred each morning when the engineer turned steam into the mains at so rapid a rate that the original air and the condensate did not have sufficient time for clearance and for warming the radiators while still maintaining pressure above atmospheric.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

A Low-Inertia Low-Resistance Heat Flow Meter

By R. G. Huebscher*, L. F. Schutrum*, and G. V. Parmelee**, Cleveland, Ohio

This paper is the result of research carried on by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS at its Research Laboratory located at 7218 Euclid Avenue, Cleveland 3, Ohio

SUMMARY — A low-inertia, low-resistance heat flow meter incorporating the principle of plate or large-area thermojunctions developed at the ASHVE Laboratory is described. Instructions for construction and calibration, and suggestions for application, are given.

THIS PAPER reports the development by the ASHVE Research Laboratory of a heat flow meter which incorporates the principle of plate or large-area thermojunctions. The principle was proposed by Benzinger,[1] who visualized it as a means for measuring the rate of heat exchange between a human subject and an enclosing box-type calorimeter having the interior surfaces completely covered with a layer of these meters. Acceptance by the Society of a contract from the Office of Naval Research for the design and construction of such a calorimeter led to an intensive development of methods and materials of construction of the heat flow meters.

Some 250 meters of this type, in different sizes and with different spacings of thermojunctions, have been constructed and are in use in the human calorimeter[2] and the Environment Laboratory[3]. Since this type of meter has other applications and possesses certain advantages, a description of construction details and calibration should be of value to others who have heat flow measuring problems. Among the advantages are: low thermal inertia, low electrical and thermal resistance, ability to integrate heat flow over the entire area of the meter, adaptability as to response, shape and size, and ease of construction. Other advantages are probable long time stability of calibration, reasonable uniformity in response of different meters of the same construction, relatively wide range of operating temperatures and good moisture resistance.

Principle of Operation

The principle of operation of this heat flow meter, in common with most heat flow meters, is the measurement of the temperature difference between opposite sides of a thermal resistance layer. The temperature difference is measured by pairs of plate-type thermojunctions. A large number of closely placed thermojunction pairs connected in series permits the thermal resistance layer to be very thin and yet produces a millivolt output large enough to be accurately measured at very low rates of heat flow.

Construction and Materials†

Principal Features

The principal feature of the construction, shown in Fig. 1, is the use of thermocouple chains made from copper-constantan foil or ribbon.

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**Research Associate, ASHVE Research Laboratory. Member of ASHVE.

[1]Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Spring Lake, N.J., June 1952.

†Specific data as to material and suppliers will be furnished on written request to the ASHVE Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

This was made by welding a bar of constantan to a bar of copper and rolling it into a thin ribbon of which half the width was copper and half constantan. The thermocouple chains were woven in basket-weave fashion over and under strips of material constituting the thermal resistance layer. Notches cut into the ribbon, as shown in Figs. 1 and 2, produce a chain of junctions identical in area and thickness, factors which materially aid uniformity of response. The meter is completed by cementing the woven assembly of thermocouple ribbon and thermal resistance layers between two sheets of aluminum foil.

Fig. 2 is an assembly drawing of the layer and foil used in the meters for the Environment Laboratory. These meters were 11½ in. square and had 48 pairs of junctions, 2.75 sq in. per pair. Fig. 3 shows a cross section through this meter. Also shown in Fig. 3 is a cross section of the meter used in the human calorimeter. This meter is 16 x 16 in. and has one pair of junctions per 8 sq in. These were spaced on 2-in. centers in both directions.

Adhesives

Two different adhesives have been used in the construction of heat meters at the Laboratory. The first was a synthetic rubber base adhesive in a solvent of ethyl acetate. Surfaces to be joined were coated with adhesive and allowed to become completely dry. The coated pieces were then assembled, placed in a vacuum press (see Fig. 4), heated to 265 F in an electric oven for 15 min and allowed to cool while under pressure.

The second adhesive was a film type adhesive, which also required heat and pressure to produce the bond between the various surfaces. This adhesive was cured by holding at 350 F for 10 min. Because of the desirability of heating the film type adhesive rapidly, an oven was not used. Instead a heavy aluminum plate with tubes brazed to one side was used as the heating element (see Fig. 5). This was connected to a tank of ethylene glycol, a circulating pump and electric heater by means of a four-way valve.

Thermal Resistance Layer Materials

The principal requirements of the layer material are:

1. Softening temperature compatible with the reactivation temperature of the adhesive used.
2. Uniformity as to thickness in order that the response of all meters be as nearly identical as possible.
3. Low shrinkage.
4. High electrical resistance.
5. Low moisture absorption.

Two suitable materials were cellulose acetate, which could be used with the rubber base adhesive, and a paper-base laminated thermo-setting plastic. This was used with the film adhesive.

Covers

Aluminum foil was selected as a cover material for the following reasons:

1. It is impervious to moisture.
2. The high thermal conductivity aids in producing isothermal regions in the vicinity of the thermojunction pairs, thereby more accurately integrating heat flow rates which may be non-uniform area-wise.
3. Its high thermal diffusivity leads to rapid response in transient heat flow.
4. It can be anodized to provide electrical insulation.

Electrical Insulation

It was found that tiny burrs on the thermocouple strip could sometimes puncture the anodized coating so that it is desirable to use additional insulation. For the meters bonded with rubber base adhesive, a 0.005 in. sheet of cellulose acetate was used. The meters assembled with adhesive film had an extra sheet of adhesive film (see Fig. 3). In addition, burrs were flattened by rolling the notched thermocouple strip.

The electrical insulating sheets were bonded to the anodized cover foils before final assembly.

Thermocouple Grid Assembly

For small quantity production, notching was done with a multiple head paper punch and shears. For large quantities the notching was done in a milling machine. Note in Figs. 1 and 2 that at the ends of certain strips, a portion of the constantan half of the ribbon is cut away so as to make the necessary copper-to-copper connection of the chains as compact as possible. The system of connections shown is designed to eliminate as far as possible

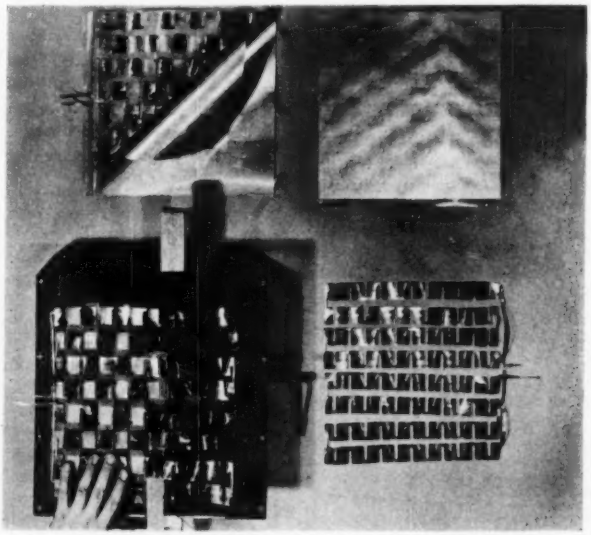

Fig. 1—Stages in assembly of 11½ in. square heat flow meters (*Lower right*) completed thermocouple chain. (*Lower left*) weaving thermal resistance layers through thermocouple chain. (*Upper left*) final assembly before bonding. (*Upper right*) completed meter

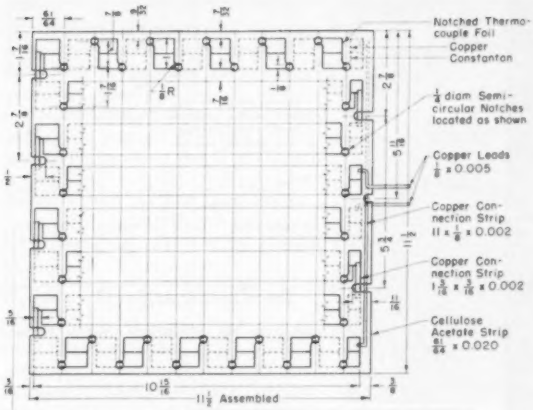
Notched Thermocouple Foil
Copper Constantan
$\frac{1}{4}$ diam Semi-circular Notches located as shown
Copper Leads $\frac{1}{8}$ x 0.005
Copper Connection Strip 11 x $\frac{1}{8}$ x 0.002
Copper Connection Strip 1$\frac{3}{16}$ x $\frac{3}{16}$ x 0.002
Cellulose Acetate Strip $\frac{61}{64}$ x 0.020
11$\frac{1}{2}$ Assembled

Fig. 2—Assembly of thermocouple foil and cellulose acetate strips for 11½ in. square heat flow meter

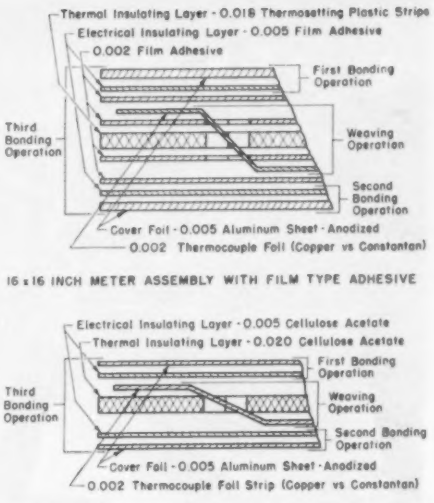
Thermal Insulating Layer - 0.018 Thermosetting Plastic Strips
Electrical Insulating Layer - 0.005 Film Adhesive
0.002 Film Adhesive
First Bonding Operation
Third Bonding Operation
Weaving Operation
Second Bonding Operation
Cover Foil - 0.005 Aluminum Sheet - Anodized
0.002 Thermocouple Foil (Copper vs Constantan)
16 x 16 INCH METER ASSEMBLY WITH FILM TYPE ADHESIVE
Electrical Insulating Layer - 0.005 Cellulose Acetate
Thermal Insulating Layer - 0.020 Cellulose Acetate
First Bonding Operation
Third Bonding Operation
Weaving Operation
Second Bonding Operation
Cover Foil - 0.005 Aluminum Sheet - Anodized
0.002 Thermocouple Foil Strip (Copper vs Constantan)
11½ x 11½ INCH METER ASSEMBLY WITH RUBBER BASE ADHESIVE

Fig. 3—Enlarged cross section through heat flow meters

the effect of a temperature gradient on the surface to which the meter is attached. If a gradient exists, the thermocouple chains will measure this temperature gradient as well as the gradient normal to the meter. This, of course, will add to, or decrease, the electromotive force (emf) due to the heat flow itself. The manner of connecting the chains as shown completely compensates for a gradient along the chain and partially cancels a gradient at right angles to the chain. This point should be observed in applications of the meters.*

Calibration of Heat Meters

Comparison Methods

In some applications it is only necessary to know the relative output rather than the absolute calibration constants of heat meters. Also it is sometimes necessary to sort meters according to their relative outputs in the event that they may be applied to a surface and calibrated there. The cube comparison was found to be one satisfactory method. A box with an open top was made up of five heat meters and heavily insulated on the outside. An electrical heating unit was suspended in the center of the box, which was then closed by a sixth meter. This meter was left uninsulated. The total output of the six meters was measured. If the sixth meter was then replaced by another, the two had identical constants, if the total output was the same in each case. Careful control of room conditions contributes to the precision of comparison.

A second method of calibration is to arrange equipment so that heat can flow through two or more meters in series. It is important that the thermal resistance between the heating and cooling surfaces be uniform over the whole area to obtain best results. Edge heat leakage can be controlled by methods suggested in a recent paper.[4]

Calibration Methods

The principal problems encountered in calibrating the heat meters were those due to non-uniform thermal resistance between the hot and cold plates of the calibration

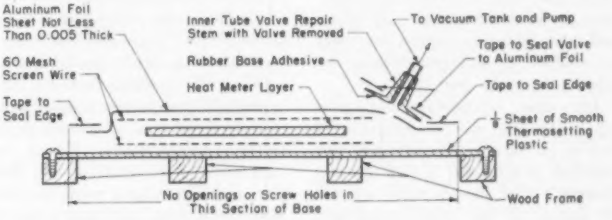
Aluminum Foil Sheet Not Less Than 0.005 Thick
60 Mesh Screen Wire
Tape to Seal Edge
Inner Tube Valve Repair Stem with Valve Removed
Rubber Base Adhesive
Heat Meter Layer
To Vacuum Tank and Pump
Tape to Seal Valve to Aluminum Foil
Tape to Seal Edge
⅛ Sheet of Smooth Thermosetting Plastic
No Openings or Screw Holes in This Section of Base
Wood Frame

Fig. 4—Vacuum press used in assembly of 11½ in. heat flow meters

*Detailed procedure in assembly will be furnished upon written request to the ASHVE Research Laboratory, 7218 Euclid Ave., Cleveland, Ohio.

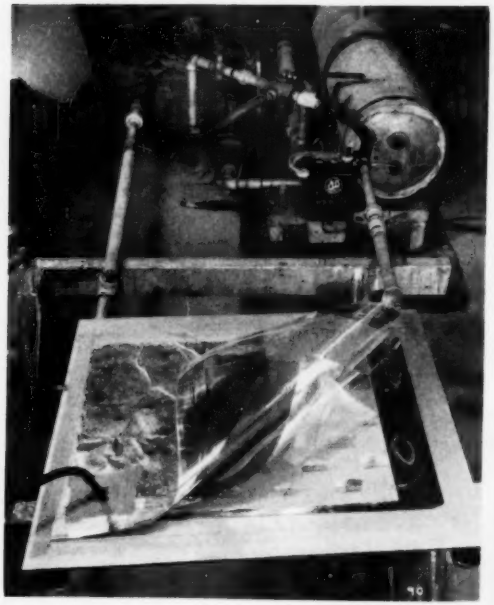

Fig. 5—View of vacuum ptess used in assembly of 16 in. heat flow meters

Shown are foil cover sealed to heating plate, screen wire, foil cover of meter, film type adhesive, and assembled grid of thermal resistance layer and thermocouple chains. Heating unit and pump are shown in background

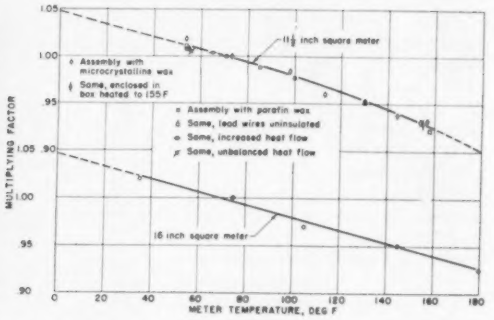

Fig. 6—Effect of temperature on calibration constant of heat flow meters

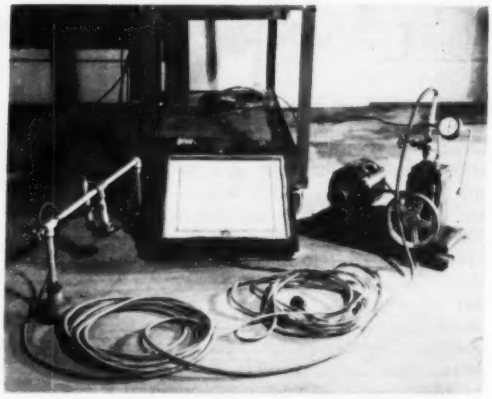

Fig. 7—Portable heat meter calibrator with suction cup holders and vacuum pump

apparatus and edge heat leakage. Except for a few pilot models none of the meters constructed were of the proper size to be used in the guarded hot plate available. In calibrating these in the guarded hot plate apparatus considerable care had to be used in assembling the meters between the plates. Sheets of ½-in. rigid insulation and blotting paper were used between meters and plates and also between meters in order to produce a uniform thermal resistance over the test area.

The most satisfactory apparatus for calibration was an assembly of two ¼-in. sheets of hardboard, two matched meters and a thin heating element. The meters were selected by means of the cube comparison device. The heating element was placed between the two meters, and this assembly was placed between the two hardboard sheets. Each component of this assembly was exactly the same size as the heat meter, in this case 11½ in. square. The heating element consisted of copper nickel alloy ribbon bonded to a 1/32-in. thick anodized aluminum plate. The whole was assembled with microcrystalline wax, which had a melting point of 170 F, between each layer.

Calibration was carried out by placing the assembly between 12-in. square hollow copper plates through which water was circulated at controlled temperatures. Power was metered by a precision watt meter and corrections were made for power loss in the meter and lead wires. The edges of the meter and heater assembly were insulated with one inch of hair felt. Edge heat flow was experimentally determined by measuring the output of the heat meters with the plates held at various temperatures different from ambient and with no input to the heater. The correction for edge heat flow was about 3 percent at 50 deg temperature difference. Satisfactory assemblies were also made with paraffin, which, however, limited the maximum temperature at which calibration could be carried out. Except as noted on Fig. 6, all tests were carried on with a constant input to the heater and with no edge guarding.

The 16-in. meters were calibrated after the meters were applied to the inner surface of the human calorimeter. The total output of all the

meters was measured at different temperatures during which time heat was supplied to the calorimeter by a large low temperature heating element.

The temperature dependence of the calibration constant for the 11½-in. and 16-in. meters is shown in Fig. 6. At 70 F the constant of the smaller meter is 66.2 Btu per (hr) (sq ft) (millivolt) and of the larger meter is 81.0 Btu per (hr) (sq ft) (millivolt).

Portable Calibrator

The device shown in Fig. 7 was built to calibrate the 11½-in. meters after they were bonded to the interior surfaces of the Environment Laboratory.[3] This consisted of an ⅛-in. thick sheet of anodized aluminum, 15½ in. square, to the rear surface of which was bonded a flat constantan ribbon heating element. One of a pair of meters, calibrated as just described, was bonded to the center of the front surface of the aluminum plate by means of microcrystalline wax. This was surrounded, as shown, by a 1/32-in. thick strip of balsa wood placed about ¼-in. from the edges of the meter. The outer perimeter of the heater plate was bordered by a strip of hardboard and a sponge rubber gasket. The back was insulated with 2 in. of cork. The unit was held in place over the meter to be calibrated by means of a vacuum pump and cups causing the holding pressure. In use, the gasket rubber was compressed to the point where the balsa wood baffle acted as a stop so that an air space of ¼ in. was formed between the calibrated and the uncalibrated meters.

Comparisons with the second of the pair of calibrated meters bonded to a cooling plate proved that edge effects were negligible. Comparisons in various positions were completely satisfactory.

Thermal Resistance

The thermal conductance of the 11½-in. square meter was determined during calibration to be 33.9 Btu per (hr) (sq ft) (F deg) at 145 F.

The thermal conductance of the 16-in. square meter with a thermo-setting plastic layer was calculated to be 58.1 Btu per (hr) (sq ft) (F deg).

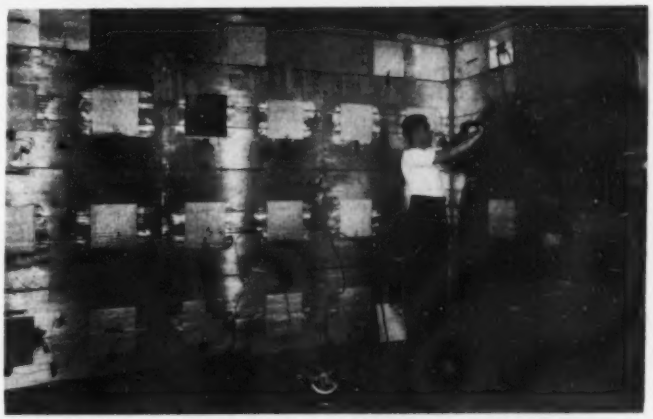

Fig. 8—Application of heat flow meters to aluminum panels of the Environment Laboratory

Transient Response

One of the factors of major importance in the development and operation of this instrument is its rapidity of response to changes in heat flow rate. This transient response was evaluated as follows.

One of the 16-in. meters was fastened in good thermal contact to a flat isothermal aluminum plate that was maintained at constant temperature. An isothermal aluminum plate with integral heater was mounted 8 in. above the first plate to provide a heat source. The surface of the heater, meter and mounting plate for the meter were blackened with high absorptivity paint. Between the heat meter and the heater plate a multiple aluminum foil shield was inserted.

To obtain a response curve, the shield was removed and the emf output of the heat meter was recorded on a high speed millivolt recorder with high chart rate. The time to reach final equilibrium was approximately 45 sec and the time constant (time for 63.2 percent response) was 7.62 sec.

Stability of Meter Constant

Two 8-in. square meters constructed of cellulose acetate and rubber base adhesive were subjected to accelerated life tests. One was alternated between an ice bath and a 185 F oven for 92 cycles, remaining 15 min in each. An increase in meter output of 3½ percent resulted after 18 cycles. Additional cycles failed to cause any change. One hundred passes with a roller with about 45 lb pressure after this cycling test caused no change. The other meter went through 35 cycles of 5 min at 212 F and 10 min at −70 F. An increase in output of less than 3 percent was found. In these tests a third meter was used as a control. There is good reason to believe that the meter of thermo-setting plastic and film adhesive would show even better stability.

Applications

Precautions in Use

Two laboratory type applications have been mentioned. Field applications are numerous. Some precautions must be observed of which the most important is uniformity of contact resistance over the entire surface of the meter. The meters installed in the Environment Laboratory were bonded to the surfaces by means of a tape, adhesive coated on both sides. Application of heat and pressure produced a bond that would damage the meter in removal unless extreme care were taken. Fig. 8 shows the method

of application and some of the meters which have been installed in the Environment Laboratory. Temporary attachment can be made with paraffin. If a heat flow field is to be surveyed by means of a meter, it would be desirable to bond the meter to a flat aluminum plate of sufficient stiffness so that good contact can be made by applying pressure at a few points. Some provision must still be made to fill small voids between the surface and the meter.

It is obvious (see Fig. 6) that the meter constant must be selected in accordance with its temperature.

Correction for Thermal Resistance

Unless the overall resistance of a wall section is very large, a correction must be applied for the additional resistance imposed by the heat meter. Several methods of correction can be used. If q_w = unit rate of heat flow through the section not covered by a meter, and q_m = the unit rate of heat flow indicated by the meter, then

$$q_w = q_m (t_w - t_o)/(t'_w - t_o) \quad \ldots(1)$$

where

t_w = temperature of the wall surface not covered by the meter, Fahrenheit.

t'_w = temperature of the wall surface covered by the meter, Fahrenheit.

t_o = temperature of the air on the far side of the wall, Fahrenheit.

If t_o cannot be conveniently determined the following equation can be used:

$$q_w = q_m (t_i - t_w)/(t_i - t_m) \quad \ldots(2)$$

where

t_i = the temperature of the air, or that of the solid surfaces seen by the meter, or a combination of both, Fahrenheit.

t_m = the exposed surface temperature of the meter, Fahrenheit.

Note that addition of the heat meter to a thermal resistance circuit changes the temperature levels in all parts of the system. Hence t'_w and t_m must be steady state values.

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2. Annual Report of Committee on Research (1949), Report of Director of Research — Cyril Tasker (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1950, p. 122).

3. The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee, and L. F. Schutrum (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1952, p. 119).

4. Analysis of Errors in Measuring Thermal Conductivity of Insulating Materials, by E. V. Somers and J. A. Cyphers, (*Review of Scientific Instruments*, Vol. 22, August 1951, p. 583).

EVALUATION OF PROPERTIES OF THERMAL INSULATING MATERIALS

The ASTM Committee C-16 on Thermal Insulating Materials, of which E. R. Queer, State College, Pa., a member of ASHVE, is chairman, reported on the progress of the committee at the *ASTM* Committee Week in Cleveland, March 3-7. According to the report by *ASTM*, handleability of block and pipe thermal insulating materials is recognized as being an important property, and this committee has been studying methods of evaluating this. At the committee meeting in Cleveland, two instruments were agreed upon for determining data by which field handleability can be evaluated, these being an impact pendulum and a drop machine type.

The Subcommittee on Block and Pipe Insulation reported on an impressive list of proposed test methods and specifications, including a method for measuring the resistance to vibration. A change in the size of the mold will be made in the specification for Mineral Wool Molded Type Pipe Insulation (C 281 T). Several proposed specifications were accepted covering various types of pipe insulation, including laminated asbestos paper type insulation, 85 percent magnesia block and pipe, mineral wool block or board for low temperatures, mineral wool board for roofs, mineral wool block or board for elevated temperatures, and diatomaceous earth block and pipe. A proposed sampling procedure was also accepted for letter ballot.

Subcommittees interested in structural insulating board and blanket insulation reported developmental work on small scale methods for determining flame resistance. A racking load test for structural insulating board sheathed wall panels has been prepared.

Round-robin tests in six laboratories using a proposed method for determining specific heat have been completed and the data will be studied. In preliminary work on a maximum use temperature limit test, it has been found advisable to remove the shrinkage-after-soaking procedure and place it in a separate method. The procedure for measuring warpage will also be set up as a separate method. A proposed method for testing water vapor transmission for materials thicker than ⅛ in. is now ready for subcommittee ballot.

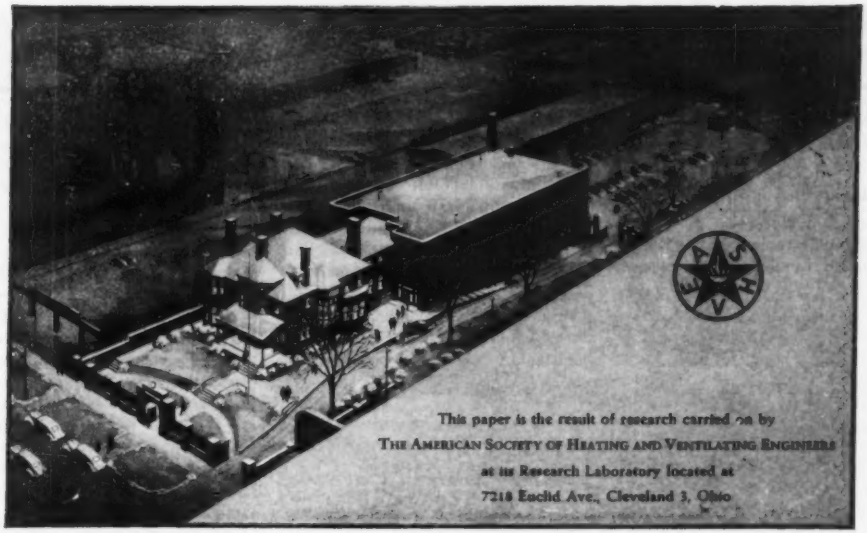
REMA HOLDS CONFERENCES

The 9th All-Industry Refrigeration and Air Conditioning Educational Exhibit and Conference, sponsored by the *Refrigeration Equipment Manufacturers Association*, was held in Convention Hall, Philadelphia, May 2, 3 and 4, 1952.

The next Refrigeration and Air Conditioning Educational Exhibits and Conferences have been announced by the association as follows:

The 10th Conference in the series will be held in Miami, Fla., on December 5, 6, and 7, 1952. Exhibits will be housed in the Miami Municipal Auditorium.

A third conference will be held in the spring of 1953 on the West Coast.


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Outlet Turbulence Intensity as a Factor in Isothermal-Jet Flow

By H. B. Nottage*, J. G. Slaby†, and W. P. Gojsza†, Cleveland, Ohio

SUMMARY — An exploratory test has shown that outlet turbulence intensity is a significant factor in isothermal ventilation-jet flow when the outlet velocity is low. This is important to outlet design and also must be recognized in the layout of room air distribution systems. A Schubauer type of heat-diffusion turbulence indicator has been developed for use under ventilation conditions

NO PRIOR data have existed concerning the effect of a change in outlet turbulence intensity, all other factors remaining unchanged, upon the velocity field of an isothermal ventilation jet. An exploratory investigation of this point has been recommended by the Technical Advisory Committee on Air Distribution.‡

The results reported here have been obtained as part of the long-range research program on room air distribution at the ASHVE Research Laboratory.[1,2,3,4,5]

The motion of room air, at any instant of time and at any position within the confining space, is governed by the forces acting at that position. These forces, in turn, depend upon the local turbulence conditions[2] as well as upon the nature of the time-mean motion.

Turbulence mechanisms within a moving fluid are very important influences in the rate of dissipation of the available mechanical energy of flow. An important question in practical ventilation work is how this dissipation rate may be related to turbulence intensity at the outlet into a room. Evidence on this point is obtainable from a comparison of jet velocity fields. Thus, the present investigation, while merely an introduction to a very broad topic, has important fundamental connotations.

Scope

A previous paper[5] has described the general experimental installation from which the present data were obtained.

The exploratory intent was served by the following steps:

1. Development of a device to obtain a quantitative measure of turbulence intensity.
2. Development of means of altering the outlet turbulence intensity with no significant change in the mean-velocity distribution at a given flow rate.
3. Obtaining the variation of maximum jet velocity with distance from the outlet for the different outlet conditions imposed. This limitation to maximum velocity alone was adopted to minimize the experimental time and detail, fully recognizing that only a partial answer would be obtained thereby.

Test conditions were limited to isothermal flow. Jets from only two mean outlet velocities were studied, namely, 350 and 2500 fpm. Outlet conditions, however, were investigated over the range of 100 to 6000 fpm mean outlet velocity.

Three outlet conditions were included, comprising: (1) a free open outlet, (2) the special turbulence promoter added to the outlet, and (3) the intake of the outlet nozzle covered with a piece of ordinary woven-wire window screen.

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†Research Engineer, ASHVE Research Laboratory.

‡Personnel of TAC on Air Distribution: G. B. Priester, *chairman*, H. F. Brinen, R. M. Conner, S. H. Downs, Linn Helander, F. B. Holgate, W. O. Huebner, W. W. Kennedy, R. D. Madison, G. E. McElroy, L. G. Miller, H. C. Pierce, C. H. Randolph, T. H. Troller, R. D. Tutt, G. L. Tuve.

[1]Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Spring Lake, N. J., June 1952.

The outlet was the same as previously employed[3], namely, a 6-in. *ASME* standard long-radius nozzle.

Turbulence Indicator

Construction Features

Aerodynamic research has evolved experimental techniques in hot-wire anemometry[6] which enable local turbulence conditions to be thoroughly examined. These methods however are rather elaborate for practical studies in air distribution. The heat-diffusion turbulence indicator of Schubauer[7] accordingly was selected as a more simple means of quantitative measurement.

Fig. 1 shows the indicator in the form employed. A 40-gage alloy constantan wire is supported on needle points along the vertical axis of rotation. This wire is set perpendicular to the fluid velocity and heated electrically. Setting the wire vertically minimizes the distortion of its heated wake by buoyant forces. A 40-gage thermocouple is mounted parallel to this wire at a distance downstream which can be varied to suit operating conditions. Rotation of the U-shaped member traverses the thermocouple across the wake of the wire. The *cold* junction of the traversing thermocouple is intended to sense the temperature of the undisturbed stream and is placed within a small wire cage as an aid to thermal stability. Angular positions along a wake traverse are determined with a precision protractor, carefully centered on the axis.

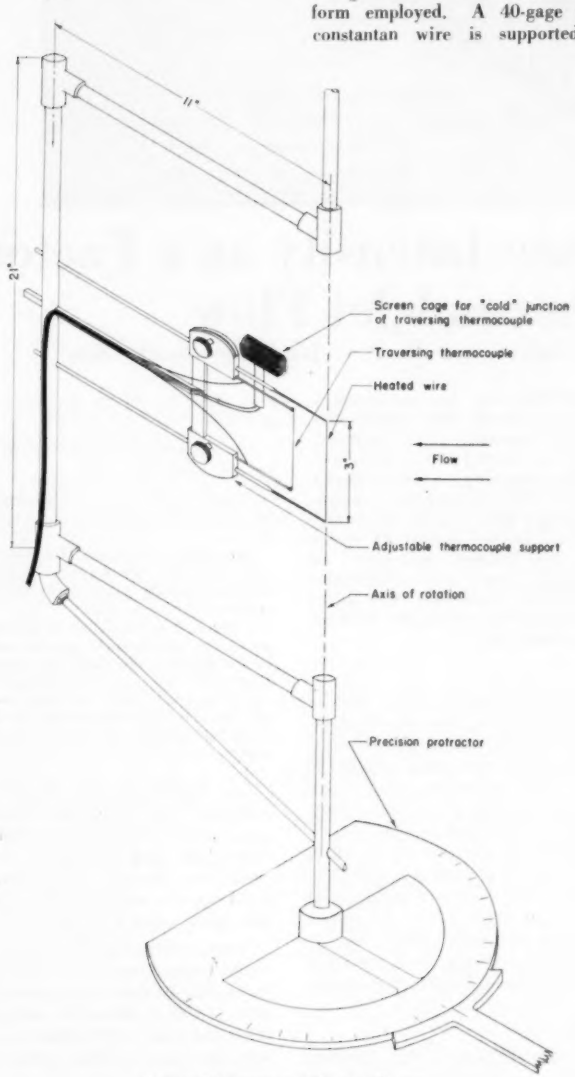


Fig. 1—Schubauer turbulence indicator

Galvanometer

To minimize buoyant action on the heated wake, temperature increases had to be as low as could be conveniently handled. The electromotive force (emf) from the traversing thermocouple was placed directly across the terminals of a reflecting-mirror galvanometer. This galvanometer was fitted with a special coil and a special suspension such that it yielded a sensitivity of 0.06 microvolts per millimeter of scale deflection for a scale distance of 9.8 ft. With this sensitivity and a scale length of two meters, the greatest wake temperature increase across any traverse was less than 5.0 deg Fahrenheit.

Galvanometer damping was a critical factor, because the fluctuations particularly inherent in jet flow made it otherwise very difficult to obtain time-mean data. Following a series of attempts, a satisfactory damping arrangement was devised which comprised the following:

1. A small arm, in the form of a fine non-magnetic wire, attached to the suspension just above the coil and bent downward at its outer end.

2. A small trough (of non-magnetic material) in the form of a circular arc, which was filled with a viscous liquid and attached to the magnet pole pieces in a position such that the end of the small arm moved in the trough with rotation of the coil.

3. Adjustable damping, obtainable by

Nomenclature

c_p = unit heat capacity of the fluid at constant pressure, Btu per (pound) (Fahrenheit degree).
D_o = outlet diameter = 0.5 feet.
k = thermal conductivity of the fluid, Btu per (square foot) (hour) (Fahrenheit degree per foot).
U = mean velocity of the fluid, feet per hour in Equation 3, otherwise feet per minute.
x = distance from outlet along jet axis, feet.
x' = distance between heated wire and the traversing thermocouple, for Equation 3, feet.
α = angular interval in the wake traverse between the points of 0.5 temperature-difference ratio, for Equation 2, angular degrees.
α_t = defined by Equation 2, angular degrees.
α_o = defined by Equation 3, angular degrees.
ρ = fluid density, pounds per cubic foot.
ρ_o = standard air density of 0.075 lb per cu ft.

varying the viscosity of the liquid and the depth of immersion for the moving arm.

The entire circuit containing the thermocouple and the galvanometer was calibrated in place by imposing a known emf. This calibration showed galvanometer displacement to be proportional to the impressed thermocouple emf over the range of the data to be taken.

Use of the Indicator

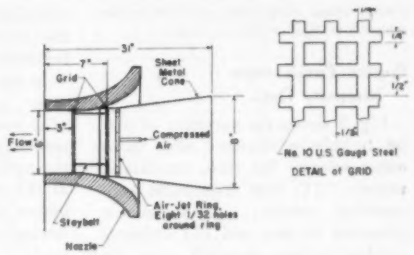
The indicator is intended for use in a region of uniform velocity and temperature and in isotropic turbulence.[2,7] Jet turbulence generally is non-isotropic,[8] but the use of the indicator is suggested to obtain reproducible data which at least will be representative of the true order of magnitude.[9]

Procedure in the use of the indicator was as follows:

1. Velocity, temperature, and density of the air were established for the position chosen.

2. The assembly was positioned to set the heated wire in the desired location, and the heating current and the traversing thermocouple position were adjusted interdependently to bring the maximum deflection of the galvanometer light spot conveniently on the scale.

Fig. 2—Turbulence promoter



3. The galvanometer zero position was taken, using care to insure reproducibility.

4. Data were recorded of galvanometer deflection *vs.* angular position of the traversing thermocouple across the wake.

Even with strong damping, the light spot did not maintain a fixed position. A satisfactory procedure for obtaining the time-mean position was to have the operator take repeated instantaneous readings of lightspot position at a convenient timed interval and to record these readings directly on the keyboard of an adding machine. Experience showed that a good time-mean average reading could be obtained from 50 to 100 of such entries, depending upon the experimental conditions.

5. Deflection data were plotted as the ratio (deflection) ÷ (maximum deflection) *vs.* angular position of the thermocouple.

The linear calibration of the galvanometer scale, plus the linearity of the thermocouple emf per unit of temperature difference over the range involved, meant that this ratio represented the corresponding temperature-difference ratio. These plottings gave the bell-shaped error-function curve. The angular interval between the positions on the two sides of this curve where the temperature-ratio ordinate had the magnitude 0.5 was measured for use in computing the turbulence intensity.

6. Turbulence intensities were calculated from Schubauer's formula, (Equation 1).

By definition, intensity is the ratio of the root-mean-square fluctuating velocity to the time-mean velocity. From the data,

$$Intensity = \frac{\alpha_t}{134.7} \quad \text{(1)}$$

$$\alpha_t = \sqrt{\alpha^2 - \alpha_o^2} \text{ angular degrees} \quad \text{(2)}$$

$$\alpha_o = 190.8 \sqrt{\frac{k}{\rho U c_p x'}} \text{ angular degrees} \quad \text{(3)}$$

where

U = mean stream velocity, feet per hour.
k = thermal conductivity of the fluid, Btu per (hour) (square foot) (Fahrenheit degree per foot).
c_p = unit heat capacity of the fluid at constant pressure, Btu per (pound) (Fahrenheit degree).
ρ = fluid density, pounds per cubic foot.
x' = distance between the heated wire and the traversing thermocouple, feet.
α = angular interval in the wake traverse between the points of 0.5 temperature-difference ratio, angular degrees.

The present studies involved use of the indicator only in the immediate vicinity of the jet outlet. The particular design employed however would be unsuited to use in regions of strongly billowing and surging flow, where the dimensions of the device would be too small relative to the size of the eddies and billows encountered.

Turbulence Promoter

Exploratory development testing was required to establish a means of changing the outlet turbulence intensity without altering the velocity distribution at a given total flow rate. Devices fitting over the nozzle discharge face were ruled out after an exploration of grids, because the velocity profile was significantly changed by such arrangements.

Comparisons were made for various devices located at the nozzle intake. A description of these devices follows:

1. Disc-and-doughnut baffles. These produced insufficient increase in outlet turbulence intensity.

2. Single and multiple grids, various percentages of open area. These produced insufficient increase in outlet turbulence intensity when placed over the nozzle intake.

3. Rotating chopper followed by a flow straightener. These produced a badly distorted outlet velocity distribution.

4. Small air jets, shooting radially inward across the nozzle intake. These were promising but difficult to adjust to produce no disturbance of outlet velocity distribution.

5. Combination of two grids with radially-inward air jets between them. This was the best of the arrangements tested. Details are shown in Fig. 2. The radial-jet air supply was taken from a small com-

pressor whose intake was connected to the metered ventilation-jet air supply.

Outlet Turbulence-Intensity Data

Fig. 3 shows the variation of outlet turbulence intensity with mean outlet velocity for three conditions, vamely: (1) free open outlet (unmodified nozzle); (2) turbulence promoter in use; and (3) ordinary window screen stretched over the nozzle inlet.

The results for the free open outlet show that turbulence intensity may be a hidden variable in comparative jet behavior over a range of outlet velocities. The previously reported data on isothermal jets[3] are a case to the point.

The relatively constant magnitudes shown in Fig. 3 for the screen and the turbulence promoter are interesting in contrast to the open outlet. This is believed to tie in with the turbulence in the open outlet being highly susceptible to influences upstream in the flow system, while the turbulence from the other arrangements was predominantly of local origin at the nozzle.

A still greater turbulence intensity presumably could have been produced from the turbulence promoter with further development testing; but the results attained were sufficient for initial exploratory purposes.

In the fundamental sense, intensity alone is an incomplete description of a state of turbulence. The companion characteristic is the scale of the turbulence[2], which is a measure of the mean size of the turbulence eddies. Data on scale, however, were beyond the present exploratory interest.

Effect of Outlet Turbulence Intensity Upon Maximum Jet Velocity

Jet velocity field explorations were limited to establishing the relation between maximum velocity and distance from the outlet. These maximum-velocity comparisons were carried out at only two mean outlet velocities, namely 350 and 2500 fpm.

At 2500 fpm the change of turbulence intensity within the limits of Fig. 3 produced no appreciable change in the maximum-velocity variation.

At 350 fpm a significant effect was found, as shown in Fig. 4. This shows that outlet turbulence intensity is an important variable for ventilation jets in the range of relatively low output velocities. From the previous paper[3] on isothermal jets, a guess may be made that this factor is appreciable at outlet velocities of roughly 1000 fpm and below.

From Fig. 4 it may be inferred that outlet turbulence intensity exerts its significant influence within a rather short distance from the outlet. The downward-sloping portion of the curves is characteristic of free turbulent jet flow, and the parallel trends indicate that the respective turbulence mechanisms act in the same relative manner.

Limited aerodynamic data[6] show that there is a sharp rise in turbulence intensity along a jet axis within a very short distance from the outlet; and this then is followed by an extensive region where the turbulence intensity changes but slightly. This supports the deduction that outlet turbulence changes become submerged in the strong free-turbulence behavior which dominates jet flow after a relatively short initial distance.

The demonstration that outlet turbulence intensity may be a significant variable at the lower velocities raises the practical question of outlet design. All other things being unchanged, an increase in outlet turbulence intensity will decrease the

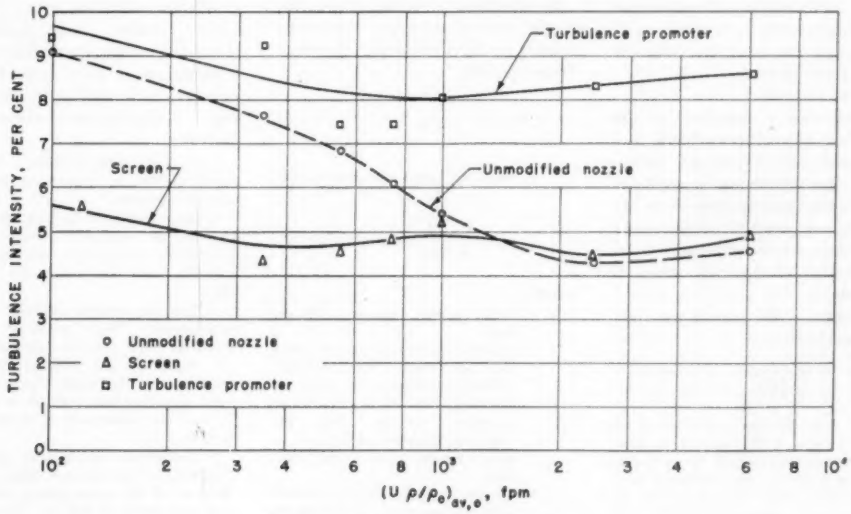


Fig. 3—Turbulence intensities at the outlet

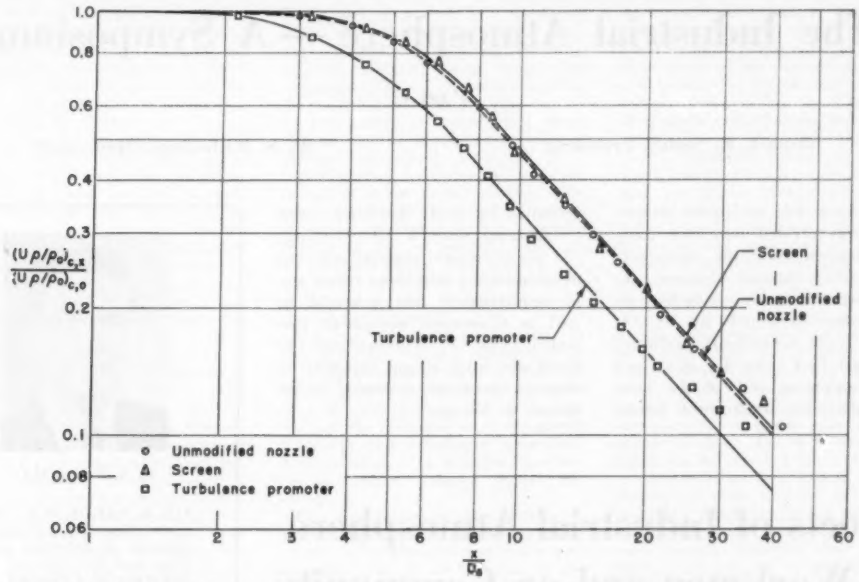


Fig. 4—Effect of outlet turbulence conditions upon axial velocity for an isothermal jet at 350 fpm mean outlet velocity

throw of a ventilation jet. Such an increase also would tend to raise the noise level.

Various outlet grilles generally would introduce changes in both velocity distribution and turbulence intensity. The effect of velocity distribution, all other variables remaining unchanged, has not been investigated in the present studies. The expectation however would be for any influence to be felt predominantly in the relatively short region between the outlet and the position where strong free-jet characteristics dominate the flow. Practical research is needed in this connection. The case of outlet swirl is an important instance.

Presumably a change in outlet turbulence intensity would also influence the position of the jet boundaries.[3] This, however, has been beyond the present scope.

The temperature field of a non-isothermal jet would be expected to change in the same general manner as the velocity field with changes in outlet turbulence intensity. This is an interesting problem for further research.

The limited exploratory scope of the present results must be emphasized. An un-touched aspect is the role of turbulence when a ventilation jet sweeps a room surface where convective heat transfer is significant. Considerations of this sort remain for the future in the long-range ASHVE research program.

Conclusions

1. The Schubauer type of heat-diffusion turbulence indicator together with a specially damped galvanometer, has proved to be a simple and useful means of quantitatively exploring outlet turbulence intensity under ventilation conditions.

2. Outlet turbulence intensity is a significant factor in ventilation-jet velocity fields for velocities below roughly 1000 fpm.

3. The present exploratory results have indicated the practical desirability of continued research on the quantitative role of turbulence in room air distribution and, by further implication, also in convective heat transfer at room surfaces swept by ventilation streams.

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The Industrial Atmosphere — A Symposium*

Part II

Dean L. E. Seeley, Presiding **W. N. Witheridge, Moderator**

THE subject, *The Industrial Atmosphere*, was divided into four parts and discussed from the viewpoints of: (1) the industrial engineer who must reconcile many conflicting requirements, presented by H. A. Mosher[1]; (2) the industrial architect who must find space for more and more equipment and, at the same time, satisfy the architectural artists, presented by A. T. Waidelich[1], who collaborated with W. A. Hunting; (3) the equipment supplier who has to translate the sometimes rather rigid requirements into practical as well as economical equipment, presented by R. P. Warren; and (4) those who work in and live near industrial operations, presented by Dr. Kehoe, as follows:

R. A. Kehoe, M.D.

• R. A. KEHOE, M.D. — Director, Kettering Laboratory, professor of industrial medicine, and director of the University of Cincinnati Department of Preventive Medicine and Industrial Health. Medical director of the Ethyl Corp. He is a member of numerous medical and technical societies and has served as an officer of several. He has contributed to many scientific publications and reference works on industrial hygiene. Named as Cincinnati's outstanding engineer for 1952.

Effects of Industrial Atmosphere on Workmen and on Community

By Robert A. Kehoe, M.D., Cincinnati, Ohio

THE TITLE of this paper presents an aspect of the problem of industrial air pollution which recently has come to be a matter of almost universal concern. For many years interest in it was confined almost exclusively to industrial physicians and hygienists, on one hand, and to industrial management and employees on the other, since it was considered to be a problem of industrial health. With the expansion of industry and the growth and development of highly industrialized cities and towns, the atmosphere of entire communities became contaminated with industrial effluents to a degree which was noted by the casual observer, and the question of public health in this connection was raised with increasing frequency. It is well that such matters should come to the threshold of public interest, since by this means the entire subject of industrial or occupational hazards comes under wider and more critical examination and finds itself related, as it should be, to the health and well-being of the community as a whole.

In bringing up the possibility of the harmful effects of human exposure to relatively low concentrations of atmospheric pollutants, another issue is created, in that the nature and extent of the danger to industrial workers and to the citizens of industrial cities must be defined in clear and distinct terms, and the specifications for a healthy atmospheric environment must be laid down for those whose obligation it is to meet them. It is on this issue which we wish to dwell for an introductory moment, in order to emphasize a professional relationship which is illustrated in this symposium and which is destined to bring order and understanding into this presently confused and previously neglected field of endeavor, as it is doing in the field of industrial health.

This professional relationship can be expressed in its simplest terms for present purposes by pointing out that it is the function of the physician and medical investigator to discover and define the limits of physical and chemical stress to which the human organism may be subjected with safety and benefit, while it is the function of the engineer to find the means of controlling the physical and chemical factors within the limits defined. Or to restate this thesis in somewhat broader terms to encompass the challenge to modern technologic society, the applications of the biological sciences, as they are or can be represented in preventive medicine, provide the specifications for a safe and healthful human environment, while the applied physical sciences which constitute engineering provide the means for meeting such specifications. Neither party to this working relationship can accomplish its purpose without the aid of the other, and if this fact is recognized clearly and acted upon, the basis will have been laid broadly and solidly for a much needed joint service of these professions to the community.

From the medical viewpoint, as we shall see, the great need is for means of obtaining the information on which the necessary specifications can be based, while from the engineering viewpoint, it is imperative to know whether and when measures of control are adequate, to the end that they can be designed effectively and economically. It should be apparent that the cost of effective control of actual industrial or public hazards can scarcely be too great, if it secures the priceless economic asset of good health and well-being in our population. By the same token, it should be evident to many, if not most

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[1]Part I published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1952, p. 127.

persons, that the complete elimination of atmospheric pollution due to industrial wastes is an impossibility, and that the cost of attempts to eliminate such pollution will be both prohibitive and fruitless, unless the limits of satisfactory performance can be known in advance.

The concept of quantitative specifications for safe and healthful conditions in the human environment leads to a physiological principle that needs to be established firmly in the public as well as the professional mind. A much too common viewpoint holds that such quantitative specifications relative to human health are, and must be, a matter of compromise between what is harmful and what is only a little harmful. Admittedly, the initial attempt to determine the point at which no harmful effect can be observed to result from a specific type and quantity of environmental stimulus is a matter of pragmatism, and as such it may be something of a compromise. The fact is, however, that there is no justification whatever, in many, if not most, instances, for the belief that if a substance or a type of energy is harmful in adequate concentration or dosage, it must be somewhat harmful in minimal concentration or dosage. The facts of life are fundamentally contrary to this concept, since the very structure of the animal and human organism is made up of most of the materials of which the earth itself is composed, these existing in a systematic relationship to each other with appropriate limits of concentration. An injurious effect upon the organism is or may be the result of a factor or factors which disturb these relationships of concentration. Hence the animal organism is intoxicated when it absorbs or retains too much or too little of one or more of a wide variety of the materials that enter into its composition and function, whereas its healthiness or normality of structure and function is dependent upon the limits of concentration of such materials. Toxicity, therefore, is not a property of a *substance*, so much as it is a matter of the *dose* or *concentration* of a substance, within a specific organism. When this principle is accepted, it is apparent at once that the concept of human safety and health in relation to atmospheric pollution comes ultimately within the scope of quantitative physiological definition. Likewise unfavorable conditions lend themselves to corresponding definitions.

Sources of Atmospheric Pollution

Some perspective can be brought to bear on present problems of industrial atmospheric pollution by the recognition of the fact that the air breathed by man has always been contaminated with potentially disagreeable and harmful materials.

Natural pollution of the atmosphere has resulted from the escape of gases, vapors, mists, fumes and dusts from volcanoes, geysers, hot springs, caverns, and swamps. Forest and grass fires have distributed smoke and ashes over wide areas, while sand, soil, and products of vegetation (*e. g.* pollens) have been borne across entire continents. There can be little doubt that the natural contamination of the respired air with pollens has caused more human distress than all of the other combined sources of atmospheric pollution.

Non-industrial pollutants also contribute extensively to the modern problem. The use of fuel in the household, the burning of leaves, trash, and garbage, and the creation of dust by vehicular traffic are all significant sources of air pollution, over and above the products of the combustion of fuels in privately owned and operated automobiles and trucks.

Industrial wastes discharged into the atmosphere are composed substantially of all of the materials of industry, their combustion products, and their products of chemical decomposition and interaction, and with the rapid and continuing growth of industry these materials are to be found in the atmosphere of industrial communities in steadily increasing number and variety.

The combination of these sources of pollution poses a series of problems which increase in complexity and in degree with the years. All of the elements in the earth's crust can be expected to find representation in the atmosphere, together with a large number of their chemical compounds.

Unfavorable Effects of Atmospheric Pollution

From the aspect of human happiness and well-being, certain undesirable effects of atmospheric pollution are undebatable, the only questions at issue being those relating to the degree of significance of these effects upon health of mind and body. A group of these might be referred to for present purposes as psychic or aesthetic effects. In this category may be listed disagreeable or nauseous odors. To these may be added the depressing effects of dirtiness and dinginess of person, clothing and general surroundings outside (sootiness and the injurious and corroding effects of atmospheric conditions on vegetation, buildings, and other external aspects of the landscape) and inside dwellings and public and private buildings (soiled windows, drapes, furnishings and walls). The exclusion of sunshine by overlying smoke and smog may or may not have an important influence upon human health, but it certainly subtracts something from the sense of well-being and good spirits of men generally.

Definite discomfort of the body is also an undesirable consequence of the presence in the atmosphere of a number of commonly occurring irritating substances. Among these objectionable materials are certain acid gases, as well as aldehydes and other products of incomplete combustion of household, industrial and vehicular fuels. Infrequently, and yet, it seems, with increasing frequency, these effects are noted by travelers and city dwellers. The dense smoke of the railroad station, yard and tunnel, the visible and appreciable exhaust discharges from buses and trucks in terminals and city streets, and the sometimes acrid and penetrating effluents from nearby industrial plants, are examples which most people will recognize in retrospect even if they have accepted them as the inevitable consequences of our economic life. An occasional irritation of the eyes, nose and throat and an occasional associated headache from such a source or sources will certainly be disregarded by most of those who are easily absorbed into the activities and spirit of a technologic era, but when this experience comes to be frequent, or when its severity exceeds the threshold of discomfort of large numbers of people, as seems to have been the case in recent years in Los Angeles, an increasing tide of protest gathers and demands surcease. This is a phenomenon which can be expected to occur with increasing frequency in a country whose industrial activities continue to grow in scope and complexity, and in which systematic procedures for the choice of the most favorable industrial sites, with respect to the pollution of the atmosphere, are left so largely to chance. In view of the difficulties that have developed in a number of industrial areas in the United States, of which, because of its tragic consequences, the only widely known example is that of Donora, Pa., in 1948, it is all too evident that wise industrial planning involves the recognition and consideration of meteorological factors in atmospheric pollution, as prerequisites for the location of certain types of industrial operations.

Up to the present time, no adequate evidence has been adduced to demonstrate that definite human disease, as a result of pollution of the general atmosphere of industrial cities, has occurred in chronic form—*i.e.*, as the result of continuing or intermittent exposure of human beings to prevalent or commonly occurring levels of atmospheric pollution—except in one or two highly unusual situations of which the effects could not have been foreseen (an outstanding and recent example[2] of this type being an exposure to exceedingly low concentrations of beryllium compounds on the part of city dwellers in the vicinity of an industrial plant in an Ohio city). There have been numerous localized episodes of acute illness as the result of specific industrial accidents or operating failures which have involved persons who lived in the immediate vicinity. There was also the case of Donora, previously referred to, in which an unprecedented combination of weather conditions prevented the normal (usual) dissipation of common atmospheric contaminants, and permitted their

[2]Non-occupational Berylliosis, by Eisenbud, et al (*Journal of Industrial Hygiene and Toxicology*, Vol. 31, 1949, p. 282).

accumulation in significant concentration in a deep valley over a period of days.

From time to time over the past half century, investigators have sought proof of injurious effects of certain pollutants on the health of urban populations, and have presented evidence which in their opinion substantiated their beliefs that such effects had been sustained. This is not the proper time and place for a review of the observations and opinions of these investigators, and it is not our purpose to dismiss them lightly. The fact remains, however, that none of the evidence is convincing. Moreover, in no instance thus far, have the methods employed in such investigations been adequate to yield sound answers to the questions at issue. The factors which influence the incidence and severity of such respiratory diseases as rhinitis, sinusitis, bronchitis, pneumonia, asthma and cancer are numerous, often tenuous, and extremely difficult to separate out and appraise, but it is common among both the victims and the professional students of these diseases to resort to such interpretations. (A review[3] of much of the evidence can be found in a recently published article). The result, in relation to the effects of air pollution on human health, is a type of conviction that stems from a great weight of unsubstantiated opinion (tinctured somewhat by apprehension), rather than a valid critique in sorting out and appraising the evidence. It is evident that the increasing body of professional and public opinion on this subject cannot and should not be ignored, since, on the one hand, such opinion in a democracy finds means of expressing itself in action, and since, on the other, the problems of public health involved in it are of great social and economic consequence.

Approach to the Problem

Toxicologic Approach. As has been suggested previously, adequate control of general air pollution awaits the establishment of specifications for a safe and healthful atmospheric environment. Here, the trail has been blazed by industrial hygiene, for what is known of useful methodology and of established fact derives largely from the study of the industrial environment and the reactions of workmen thereto. There are even specifications, not always as well substantiated as they might be or should be, but so formulated in the definite quantitative terms of concentration as to be useful to the engineer. The specifications, which have become a well-recognized part of industrial hygiene, are known generally as the *maximum allowable concentrations* of specific materials in the atmosphere of industrial establishments. As such, they define the threshold limits for safe conditions of work with respect to the concentrations of potentially dangerous substances which may be in the air breathed freely by men who work eight hours per day on five or five and one-half days per week.

There are at least three fundamental defects in these standards of safety for application to the atmosphere of the entire community. The first of these defects is obvious, in that the standards relate to the one third of the day and the five sevenths of the week which are spent at work, and not to the full week of 24-hour days. Some allowance, therefore, must be made for the longer period of human exposure, at least in the case of certain materials.

A second defect of these standards for any purpose beyond that for which they were established, relates to the fact that the industrial population is a selected group of adults, from which have been excluded infants and children, the aged, and those seriously disabled by illness and disease. Allowance here also needs to be made, and such allowance must be of a highly selective type based upon such specific susceptibilities as it may be possible eventually to define.

The third defect is one which seems likely to be much more significant than either of the others. It arises from the present state of our ignorance concerning the combination of the effects of a large number of substances each of which exists in low concentration in the atmosphere. Generally speaking, this has not been a problem of corresponding magnitude in the industrial environment, but it must be admitted that little has been done to elucidate it in those situations in which it has existed as a potential source of occupational hazard. It must be said, in all truth, therefore, that this is an aspect of atmospheric pollution about which little, almost no, precise information is available. Only systematic investigation can provide the answers to the problem.

A further difficulty, which is related to the foregoing issue, lies in the fact that data are not available at present to demonstrate comprehensively even the qualitative composition of the atmosphere of a single industrial city. Even more scanty is the information by which to describe the quantitative composition and the changes in the qualitative and quantitative value of industrial or non-industrial air pollution on diurnal, seasonal, topographic or meteorologic bases. It is apparent that such basic information, difficult as it may be to obtain, must be made available at least to an extent that will be illustrative and fairly representative.

Engineering Approach. If the inadequacies of toxicologic information present serious problems which will require extensive investigation, it is equally apparent that there are serious obstacles in the way of the engineer in dealing with community air pollution. The control of gases, vapors, fumes, and dusts within the working areas of an industrial plant is not always simple, but it is much simpler in principle and in practice than that of controlling the outdoor atmosphere of a city. Any confined space can be ventilated effectively and to a specification, but the engineering problem of contending with wind or the lack of wind, with highly variable ambient temperatures, and with humidity or the lack of it, often leaves little means for avoiding significant pollution of the atmosphere other than that of the substantially quantitative removal of specific industrial wastes from effluent air streams. Since the technique of such procedures may be almost or entirely prohibitive as to cost, it is evident that any hygienic specification which calls for such measures must be soundly based on reliable and acceptable evidence.

The foregoing conclusion leads naturally to the recognition of the fact that the control of industrial, as well as non-industrial, air pollution, within even those reasonable limits which may be shown to be aesthetically desirable or hygienically necessary, is destined to be an enormously costly series of operations. If such cost is to be kept within reasonable or even comprehensible limits, it becomes necessary to have definite standards which will relate the costs to hygienic necessities. Such standards can be set up only on the background of facts carefully established by systematic investigation.

Investigation of Hygienic Effects of Atmospheric Pollution

The investigation which must be carried out to elucidate the hygienic problem of atmospheric pollution and to define the limits of necessary engineering control may best be outlined briefly and in general terms, since any prediction of the details of methodology, or of the ultimate ramifications and scope of such work would be highly presumptuous. It is reasonably certain, however, that the general methodology of industrial hygiene will be adapted to the large and more complicated task. Certainly, it will be necessary to proceed along three definite and distinct but coordinated lines: (1) the determination of the composition of the atmosphere of representative industrial communities under a wide variety of conditions; (2) the establishment of the effects of the exposure of experimental animals to known concentrations and combinations of concentrations of a wide variety of pollutants; and (3) the study of large and representative segments of populations exposed to known conditions by the methods of epidemiology, augmented, to such extent as may be found necessary and feasible, by detailed clinical and physiological study of selected individuals. Such investigations will need to be carried out intensively and extensively, and over prolonged periods of time. It does not appear that there can be any very productive short cuts to the necessary information, and, therefore, it seems highly improbable that any very significant body of useful data could be obtained at best before the lapse of five to ten years, if

[3]The Epidemiology and Social Significance of Atmospheric Smoke Pollution, McDonald, Drinker, and Gordon (*American Journal Medical Sciences*, Vol. 221, 1951, p. 325).

such work were to be initiated without further delay.

Considering the urgent need for the foregoing types of information, and the necessarily high cost of obtaining them, it would seem of immediate importance that certain pilot experiments be planned and conducted along carefully coordinated lines at both public and private industrial expense, in order to test out methods for wider application, and to establish the nature, pertinence and precision of the information which can be obtained through their use. Only by such means would it seem to be possible to effect a reasonable compromise between immediately practical palliative measures and those eventually found to be necessary to promote the public health. Only by adequate provision for action in this direction can public apprehension and dissatisfaction be so allayed that legislative approaches to this problem can be based on rational and equitable principles.

R. P. Warren

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Equipment for Industrial Ventilation and Air Pollution Control

By R. P. Warren, Buffalo, N. Y.

THIS discussion of equipment may begin properly by stating the characteristics of the perfect air cleaner. Such a cleaner: (1) has absolute efficiency; (2) meets all legal requirements; (3) is constant in its performance; (4) does not require shut-down during operating hours; (5) permits easy and safe disposal of collected materials; (6) permits reuse or salvage of collected materials; (7) has as low a resistance as consistent with other characteristics; and (8) is rugged, compact, easily inspected, and is particularly adapted to the type of contaminant it is intended to handle.

An additional feature is low cost — initial, operational, and maintenance. Present air cleaners can represent only the best possible compromise.

The air cleaning equipment sales engineer will encounter his problem in one of three ways:

1. He may be asked to furnish equipment to meet specific requirements with regard to capacity, power, and performance. This situation results from the presence of a competent consulting engineer or of staff engineers from the users organization. He can meet these requirements with the manufacturer's guarantee, the rating based on a test code of an association of manufacturers, a curve showing performance under the specified conditions, or he may take an exception (complete or partial) and offer an alternate. 2. He may be given partial information about requirements and be asked to offer his best solution. He can do this by drawing on past experience, studying the requirements, or by making recommendations after stating what is known and what is assumed, and why.

3. He may be given the problem without information and be asked to offer a solution to meet a given code.

By putting into practice the ideas outlined by members of this panel the first and second conditions will increase and the third will decrease.

Equipment for Industrial Ventilation

Equipment for industrial ventilation can be classified as suitable for (1) general ventilation, or (2) local exhaust ventilation. THE GUIDE follows this classification. The major products of many of the manufacturers supplying equipment can also be so classified.

General Ventilation

A system for general ventilation will consist of one or more or all of the following: (1) air conditioning units for the control of temperature, humidity, and air cleaning; (2) ductwork; (3) a fan or air mover; (4) a grill or air outlet.

Stacks, windows, doors, leaks, and holes in the roof should also be included. However, this discussion is limited to a consideration of mechanical ventilation and particularly to the air cleaning unit.

The equipment for air cleaning in general ventilation systems includes air filters, air washers, low voltage electrostatic air cleaners, and odor control units.

Filters are of four types: (1) impingement; (2) rapping; (3) reverse jet; and (4) automatic unloading filters.

These filters are suitable for the low loadings found in general ventilation. Properly selected, they are efficient and are only ineffective when the contaminants are liquid droplets, tarry matter, or there are sub-dewpoint conditions.

Air washers may be of single bank, double bank, or sometimes triple bank types. There also are wetted cell units, either as standard or as combined with other types. These units usually are ineffective on the extremely fine particles in the sub-micron range, but do offer control of temperature and humidity, an important consideration for such jobs as motor generator rooms, automatic control equipment rooms, and textile mills.

Low voltage electrostatic units are efficient on fine particles providing the loading is light. Current practice seems to favor a combination of pre- and after-filters; the first to keep the loading low, and the second to take care of blow-off if it occurs.

Odor removal units are most important when the air supply is contaminated or all air must be constantly recirculated. It is seldom that these units are not used in conjunction with one of the others. Means are provided for re-activating the cylinders.

In the revision of Industrial Code Bulletin No. 12, New York State has taken a forward step by adding the following stipulation:

"Fresh air inlets shall be provided in every room in which an exhaust system is located for the admission of make-up air to replace that removed by the exhaust system. The fresh air supply must enter the work room in such a manner that no employee is subject to a draft of air having a temperature of more than 10 deg below the general temperature of the room or of a greater velocity than 200 fpm. When the capacity of the exhaust system is small in the judgment of the Commissioner, he may approve the use of windows, doors and other building openings in place of special fresh air inlets. The make-up air should not be taken from any location where it might

be appreciably contaminated by discharge from exhaust ducts, stacks, or other plant effluents."

This may seem elementary, but nevertheless, it has actually been difficult to persuade some engineers that air cannot be exhausted from a room unless some provision is made for a supply.

Local Exhaust Ventilation

A system for local exhaust ventilation will consist of one or more or all of the following parts: (1) exhaust hood; (2) duct work; (3) fan or air mover; (4) air cleaning unit or stack.

This discussion will be limited to consideration of item 4.

The only function of a stack is to release the effluent air at a point where it cannot re-enter a building or where the pollution in the air will become diluted within required limits.

A review of the contaminants to be removed will show the wide range which may be encountered. The loadings may range from a fraction of a grain to several hundred grains per cubic foot. The materials may be corrosive, erosive, hygroscopic or deliquescent. The purpose of the installation may range from nuisance elimination to preparation of air for recirculation to preparation of chemically clean air for a new process. A large variety of equipment is therefore required.

This equipment is described by type in Chapter 33, Part 2 of THE GUIDE 1951. This discussion will consider the types in the order presented in THE GUIDE.

Electrostatic dust precipitators differ from the low voltage design used for general ventilation in that precipitation usually occurs in a single stage. Ionization and collection are carried on simultaneously in the unit and depend on high potentials of 60,000 to 75,000 volts. There is a two-stage type which has an added primary stage of ionizer and receiving electrodes. It sometimes fulfills some needs better than a single-stage type.

High efficiencies are obtained by allowing suitable time for contact in the collector zone and by obtaining proper ratio of air-flow velocity to that of transverse velocity of the negatively charged particles toward the positive charged collector plates. Air velocity varies from 240 to 480 fpm, with negligible pressure drops.

Fabric collectors are often known as cloth dust collectors or cloth dust arresters or cloth filters. Dust is removed by passing air at low velocities, about 3 fpm, through a filter medium. The resistances through the units may vary from 2 to 8 in. water, depending on the velocity through the unit. They are generally effective on dust down to approximately 1 micron in diameter and with special designs may be even more effective than that. They cannot handle high temperatures or sub-dewpoint conditions without correction or pre-conditioning the air. These units will generally be in the form of either cloth screens or cloth bags.

There are three means of cleaning these units: (1) a manual shaking device; (2) an automatic shaking device; and (3) flow reversal or *blow-back*. The *blow-back* unit permits continuous operation with constant resistance. Blow-back may be accomplished by manifold rings or simply by directional control of air flow. There has been real progress in this field.

Wet collectors may be grouped into approximately seven sub-classifications:

1. *Static washers* are effective on particles down to approximately 5 microns. Good features of these units are high dust-holding capacities and low pressure drops across the units. Disadvantages are their size and, in the case of plate type scrubbers, frequent maintenance.

2. *The wet glass cell washers* with about ¾ in. pressure drop have some application in this field. They have a useful application on acid mists. They have a tendency to become clogged unless the dust concentration is low and the dust can be washed from the cells.

3. *Packed towers* are essentially contact beds through which gases or liquids pass. General design practice is to use a water flow of about 10 gpm per thousand cfm air flow. High temperature gases can be handled.

4. *Wet centrifugals* are made in designs in which the collector is cylindrical either in the shape of a tower or with the axis horizontal. Air is introduced tangentially and is frequently directed counter current to the flow of water by baffles or directional plates. In other instances, the travel of the air coincides with that of the water. The three elements of any air washing operation are present, namely, wetting, directional change, and scrubbing on a wetted surface. Pressure losses range from 0.5 to 6 in. Recent investigations have shown high efficiencies on fume particles having a mean diameter of 0.4 micron.

5. *Dynamic precipitators* use water sprays within a fan housing and obtain precipitation of the dust particles on wetted surfaces of an impeller with special fan blade shapes. No external pressure drop is involved, although mechanical efficiency is somewhat lower than the mechanical efficiency of standard fans. In these units the collector and the fan are integral.

6. *Orifice type collectors* — In this type the air flowing through the collector is brought in contact with a sheet of water in a restricted passage. Water flow may be induced by the velocity of the air stream or maintained by pumps and weirs. Pressure losses vary from 1 in. water or less to 8 to 10 in. For special applications pressure losses as high as 20 to 30 in. water may result when very small particles are collected with high efficiencies.

7. *Distintegrators* generally consist of more than one stage and are generally used for cleaning producer, blast furnace, or other gases when the gas is to be used in engines or other processes which require gas practically free of contamination. The spray is in the fan inlet and elimination is effected largely on the fan blades and also on the surfaces beyond. Special two-element fans may be used. The air with its dust content and water sprays, enters one side of the wheel and is discharged from the inlet of the other wheel. As the air passes through the cyclonic chamber a high degree of scrubbing action takes place. Air is cleaned down to 0.006 grains per cubic foot on normal applications for this type of device. Internal pressure loss is high.

Centrifugal dust collectors can be divided into four groups according to their effectiveness in removal of smaller dust particles:

1. *Common cyclone collectors* are usually applied for the removal of coarse dust from an airstream, as precleaners to more efficient units, or as separators for systems such as woodworking. Principal advantages are low cost and low pressure drops, ¾ to 1½ in. (this type cannot be used for high efficiency collection of fine particles).

2. *High efficiency centrifugal collectors* have been developed to obtain higher centrifugal forces on dust particles in the gas stream. They may be of orifice type, vanes being used to establish the centrifugal force. Equipment designers have made sustained efforts to increase the efficiency of these collectors. While such collectors do not generally reach an efficiency on small particles equal to that of the electrostatic, fabric, or some wet type units, their effective collection range is extended appreciably beyond that of conventional cyclones. Pressure losses in cyclones in this group range from 3 to 8 in. water.

3. *Dry type dynamic precipitators* obtain dust precipitation by centrifugal force, upon specially shaped blades exactly as in the unit described under wet collectors except that no water is used.

4. *Cinder catching fans* effect removal of solids by means of a slotted scroll. It is a fan unit which is often used for the dual purpose of dust removal and induced draft service. The efficiency gained on dust removal is of the same order as a common cyclone. Power requirements are slightly more than for a standard fan.

Settling chambers remove dust by settling in a large chamber when the velocities are reduced to the point where the particles are no longer held in suspension. Such devices have very little practical application in normal industrial problems. The pressure drops across the unit are quite low but removal of only very large particles can be anticipated.

Sonic agglomerators employ high intensity sound to coagulate low-micron and sub-micron sized aerosols such as smoke, fumes, or very fine dusts into resultant particles which are large enough to be collected efficiently with various types of dust collecting equipment. Fairly high dust concentrations, on the order of one grain per cubic foot of gas, are required for effective coagulation.

Prevention of Air Pollution

An increasing number of regulations and laws for prevention of air pollution are being enacted.

The Ringelmann Chart is widely used for the determination of density of smoke leaving stacks, but there is considerable variation in the density of smoke permitted for definite periods.

Ordinances pertaining to industrial contaminants vary in limits ranging from 0.25 to 0.75 grains per cubic foot of air or gas measured at stack temperature. It is not uncommon to find three standards in three different communities within a 20 mile radius.

No one has ever defined a nuisance, in engineering terms. Air contamination which would constitute a nuisance in a suburban community might be very acceptable in a highly industrial community. The sources of air pollution for Cleveland were classified some years ago by H. K. Dyktor as: (1) railroad and domestic smoke, (2) industrial contamination, and (3) recycling of dirt.

An idea of possible future requirements for air purification may be formed by referring to the following statement of one of the U. S. Navy Laboratories:

"*Air Purification* — On air purification our immediate problem is to develop protective filters against biological, chemical and radiological attacks. We are interested in solids and liquid particulates and also in gases and vapors. — We don't know the best way to obtain filter efficiency — we must make very accurate determinations with these particle sizes of dust loadings down to about 0.01 gram per thousand cubic feet."

A simple requirement on percentage of contamination removal is not sufficient to obtain satisfactory air cleanliness. A unit which passes 15 percent of the contaminant in gases containing 4 grains per cubic foot, when a million cubic feet of air per minute are involved, creates more nuisance than a unit which passes 40 percent of contaminant in gases containing one-half grain per cubic foot, if the volume is only 20,000 cfm.

In the field of air cleaning, great progress is being shown at the present time. The establishment of limits for contaminants is essential in order to encourage progress in the development of equipment for the cleaning of air.

DISCUSSION†

J. H. CLARKE, Whiting, Ind.: I would like to emphasize several things which have come up at this meeting and at prior meetings of the Society. At the dedication of the Environmental Laboratory at Cleveland, Cloud Wampler brought out the fact that the amount of money dedicated to fundamental research, other than process and product development, by the air conditioning industry as a whole, is extremely small. After the paper that was delivered this morning on jet fundamentals,* it was brought out that neither industry nor any individual had *earmarked* one cent to help finance the project. It seems to me that this need for fundamental research is something that should be emphasized, and is something that we, as an organization, should sell to our employers. We should emphasize the need not only for fundamental research, but also for general research so that we may find out where we stand in this industry. I think all of the speakers on this program have mentioned this point.

The speakers on the program this afternoon are to be congratulated on their particularly fine papers on *The Industrial Atmosphere*. We should all benefit from this information. One point which Mr. Mosher and Dr. Kehoe mentioned, and one which certainly will get greater emphasis in the future, is the trend toward providing conditions that are comfortable instead of tolerable for the worker. Here again, we very definitely need to sell industry on this particular point. There are too many cases where we are only trying to get by in accordance with the various codes. One case concerning a pump room will illustrate the point. The maximum allowable concentration for SO_2 gas is 10 ppm, at which point it is extremely irritating. Continuous recorded tests in the pump room except at times when pump gland failures occurred, did not indicate concentrations above 3.5 ppm, at which concentrations there were no complaints on the part of the workers. The pump room complaints had resulted from the occasional high concentrations resulting from a mechanical failure, not from the average daily conditions existing in the space. However, one of the workers was transferred from the pump room to another area comparatively free from any source of atmospheric contamination. The effect of the change was so remarkable that this worker mentioned it to an engineer who happened to be talking with him. He stated that for the first time in years he was going home and actually getting a good night's sleep, and was feeling like living again. Can anyone seriously believe that a person working year after year in the atmospheric conditions of such a pump room, where he is simply existing day by day, can work efficiently and do the kind of work that management wants him to do? I do not think he can.

Another thing that is worth emphasizing is that in this country we have about 65 million workers. I would guess that there are around 20 million working in factories. Thus, in the field of human comfort, we have a great opportunity to expand our work in the industrial areas. This ought to be of great interest to the air conditioning manufacturers because it is one of the last fields to be explored and expanded, and it offers an excellent opportunity for continued research which will expand the uses of their equipment for industrial ventilation. Today, this field is almost untouched except in the specific field of the removal of toxic or explosive contaminants. In this field of comfort, we are still at the stage where industry does not want to be bothered with it. The word *comfort* seems to be taboo in many places, and as a result human ventilation is supposed to be discussed in terms of tolerable conditions.

It was interesting to note that one of Mr. Waidelich's illustrations brought out a very important requirement for worker ventilation in industrial buildings. That is the necessity of bringing the air down to the worker. The slides showed low outlets which, if I am correct, were also directional outlets. In the use of general ventilation, it is sometimes forgotten that temperature rise is no criterion of comfort; that there is a very real need for delivering the air to the worker and providing reasonable conditions which will permit him to do his work properly.

PHILIP COHEN, Boston, Mass.: I am very much interested and impressed with the breadth and scope of the approach to this problem of industrial ventilation. I would be interested in hearing any of the members of the Symposium state how they feel the manufacturers of both air-handling and air-conditioning equipment can best contribute to the establishment of some of the standards which will aid in the solution of these problems.

J. M. KANE, Louisville, Ky.: The manufacturers of air-cleaning equipment are not only interested, but are doing many times their share in trying to provide additional information and to find the solutions of problems that confront users in the application of their equipment.

I could more effectively question Mr. Clarke's statement if I had a summary of the dollars the industry and the equipment manufacturers have spent toward finding some answers to the problems that we have

†Discussion on the entire Symposium and closures of panel members on The Industrial Atmosphere presented at the 58th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, St. Louis, Mo., January 1952.

*Isothermal Ventilation — Jet Fundamentals, by H. B. Nottage, J. G. Slaby and W. P. Gojsza (ASHVE JOURNAL SECTION, Heating, *Piping & Air Conditioning*, January 1952).

been discussing today. I think of the Los Angeles air pollution problems that have received so much publicity. The approach to a solution used in this city has probably confused us a great deal as to what the proper tolerances should be in other communities endeavoring to solve air-pollution problems.

The industrial equipment manufacturers alone have spent some half million dollars in exploring the problems that are confronting Los Angeles, finding out where the dividing line is on reasonable cost for air-pollution control equipment. Air cleaning equipment must be developed and be available so that industry can purchase it at reasonable cost and operate it with reasonable maintenance.

Industry in the Los Angeles area has, probably, spent ten times the amount I have listed in pure scientific research as well as investigations in their own plants to determine how much they contribute to the problems of air pollution, and how they can practicably reduce the contamination. Los Angeles efforts are a bit more dramatic and drastic than those required in most sections of this country, but we find industry-sponsored and equipment manufacturer-sponsored investigations both of the practical field research type and of the theoretical type going on in research institutions, such as *Battelle Memorial Institute*, the *Industrial Hygiene Foundation*, and an impressive list of other places.

We lose sight of the fact that air pollution has suddenly hit the headlines and it looks like a new subject that no one ever thought of before. Members of industry have long been aware of their obligations as good neighbors in their communities to a degree that few people who write articles on air pollution have ever recognized.

I have been associated with air cleaning in industrial operation for some 18 years, and have found that most industries have been installing air-cleaning equipment to remove effluents from their stacks with as effective cleaning characteristics as possible, at reasonable cost and reasonable maintenance.

The problems that are causing the greatest air pollution concern are the problems usually involving, unfortunately, high temperature gases for which I do not believe the equipment designer has yet found equipment that is within practical cost limits, or that is not going to add a tremendous cost burden. Dr. Kehoe pointed this out in his address.

Possibly one yardstick that may help us get some kind of a common sense approach to community objectives in cleaning solids from stack gases in our industrial operations, can be gleaned from this observation that many of the standards proposed today are standards of air cleanliness to a degree that no stoker-fired or pulverized fuel boiler installation in this country, with the air-cleaning equipment now being used, could reach. Industry is being asked to meet these standards in some of the other high temperature stack gas-cleaning problems.

H. G. Dyktor, Cleveland, Ohio: I congratulate you on having obtained such a distinguished panel. I was most interested in what each one had to say. It certainly was very constructive.

Mr. Mosher talked about the comfort values as related to maximum allowable concentration allowed in health work; and he recognized the fact that human comfort as well as safety is required. I only hope that in trying to reach that comfort goal within the plants the quantities of waste material discharged into the air will not be a nuisance to the neighborhood.

In Mr. Waidelich I finally find an architect who is interested in the orientation of the building in the city in which it is to be located. I feel that this interest should go much farther. Many of the architects I have dealt with are rather of the conservative type, and perhaps they should be, but here is a gentleman who is quite modern, up-to-date and progressive. I hope that he will pass on to his professional association the suggestion that in the future, when they locate potentially offending plants, insofar as emissions are concerned, they place them on the lee side rather than on the windward side of the prevailing winds. I am speaking from experience, unfortunately.

In this connection it may be of interest to note that an industry may be strike-bound and yet reduce but little the pollution around it. Some two years ago in Cleveland there was a strike at the steel works, and naturally our three large mills were strike-bound. We very quickly took samples of the dust around the affected neighborhoods and found that the reduction in air-borne dust amounted to only 10 percent by weight; and yet the people were quite happy because there was no discoloration incidental to the dust that they saw, and the women were quite happy on Monday that they could hang out their wash and not have it smudged the way it was at other times.

With Dr. Kehoe's presentation I am wholeheartedly in agreement. He deserves to be distinguished by the award that the Cincinnati people conferred upon him. He is one of our most eminent physicians in this particular field. I agree with him that there is a problem of satisfaction of needs. To be sure, we are dealing with human beings. Human beings, in the process of civilization and also as a result of being stimulated by progress, demand the better things of life — among them a decent living environment, regardless of their own economic standards.

It is true that we do not know what the needs of the human beings are. I have tried in my own small way — and I thought we succeeded three years ago — to stimulate the *American Medical Association* to undertake or start a study of that description. I find that there is a study going on now in the Detroit area and perhaps in five or 10 years we shall have some facts. That is how long it takes; possibly more than that, I do not know. But in the meantime, as a practical man in charge of this kind of a program in an industrial city, I know that the people are clamoring for results as of yesterday, not as of today, and they will not wait 10 years. They will not wait five years. Something has to be done.

A physician, of course, is not an engineer any more than an engineer is a physician. So when an industry is involved they call upon the engineer to do something about it and he does the best he can in reducing the emissions from the plant. It is hard work and wearisome, and yet that is the only method of abatement we know. We feel that by reducing the emissions and therefore lessening the prevailing concentration of the particular contaminant in the air, something is being done healthwise. I do not know of anything else that can be done. It is one of these complex problems that defy investigation at times.

Dr. Kehoe mentioned the question of finding out what the composition of the air is. Well, spectrographically speaking, practically the whole table of the elements can be found in a city like Cleveland. That does not mean that they are in major concentrations, but in traces, and yet, there it is. We do not know what effect even the traces of some of these elements may have, but the problem is still there. It takes a great deal of patience, knowledge and perseverance in order to do a job in air pollution control work.

F. N. Calhoon, Ann Arbor, Mich.: I would like to say first of all how pleased I am at the progress that has been made on a problem that Dr. Witheridge first broached to me about 10 years ago. I refer to the problems of getting the consideration of methods and apparatus for controlling the industrial environment into the planning stages of an industrial development instead of allowing it to be ignored until some later circumstance would require its inclusion as an afterthought. The papers presented at this Symposium give evidence that substantial progress has been made.

I would like to raise three questions which may be difficult to answer in detail, but which deserve some consideration.

1. How can we get adequate information to the individuals who install these properly designed systems, information complete enough so that they will do as good a job of installing them as is done in designing them? I ask this pointedly, because recently in a bad dust condition in a paint room, it appeared that as simple a thing as getting the roof slabs tightly joined to prevent dust and lint from the adjacent

buffing room from entering the paint room, was one of the things involved. This and several other items can be set down as inadequate installation of the system or of things affecting the performance of the system. How can we get the information to the men who do the installing?

2. How can the manufacturers and the designers place in the hands of the operators definite and clear instructions on how to operate the apparatus which is adequately designed and properly installed?

3. How can we get into the hands of the maintenance crews dependable and desirable information on how to maintain properly installed equipment so that it will continue to perform the functions for which it was designed?

I think that these questions and the accompanying one as to who can and should accept the responsibilities implied need consideration.

H. E. Ziel, Detroit, Mich.: I would like to supplement what Mr. Warren said, and enlarge on Professor Calhoon's question about getting the ventilating equipment to function. I think one of the great failings in designing a proposed building is to fail to allot space for the ventilating equipment at the proper time. It is true that when the architect makes preliminary sketches the owners of the plant probably do not have their industrial layout, and it is difficult to find where space can be allocated to put the supply and exhaust fans. Mr. Waidelich showed a very fine solution by placing the equipment in the truss space which is usually quite high, especially when buildings have the long columnar spacing. However, as some of the equipment that goes in the building extends into the truss spaces, it occurs quite often in large buildings in the neighborhood of 300 ft by 1000 ft, for example, that the best place to put the fan equipment is on the roof. This location lends itself very well to a good distribution system because a large number of units can be installed and long duct runs are not necessary. However, management sometimes steps in and does not like the idea of having 12 or 16 penthouses on the roof, and prefers to have one, two or three long penthouses. That somewhat complicates a proposed layout.

The all-important thing is that the heating and ventilating engineers should immediately cooperate with the architects at the time that the plans are in the preliminary stages. That will at least provide a better chance to work out a distribution system, including both the supply and exhaust features, and to provide a more effective distributing system with desirable operating facilities.

Mr. Warren: I think that every equipment manufacturer either has made or is in the process of making simple, understandable operating instructions. Also, I think that the maintenance instructions are either prepared or are being prepared when the equipment is only in the development stage. Professor Calhoon is absolutely right. It is one of the most difficult things to leave an installation which is operating properly and have a feeling that it is going to be operating properly six months from that time. That is probably due to a change in personnel, but there is also a burden on the purchaser to pass on adequate instructions and to train people who will operate the equipment properly.

Some years ago a manufacturer had an instruction meeting that lasted about a week. Operators were brought in from all plants, and a symposium was conducted on proper operation and maintenance of equipment.

A year ago a similar meeting was held by our company. One result of this meeting was that now an adequate and competent equipment specification carries with it an instruction that there be adequate operating instructions and maintenance instructions furnished with the equipment.

Dr. Kehoe: I would like to venture an answer to the question raised about what the equipment manufacturer can do, not with the idea of telling them what they can do, but telling them one of their problems. They will have to provide the answer.

One of the most serious problems in industry, and also with reference to community air pollution, is the problem of the small plant. What you are talking about, generally speaking, and what industry has done to solve these community problems, has been done very largely by big industry with big resources. Many of our cities are made up very largely of small industries, and the job with reference to cleanliness in the air and the achievement of certain standards in many small industries — not all, is badly done, and for the most part, I am afraid, by amateurs.

The problem, therefore, is not solved and the desirable conditions are not achieved either within the plant or without.

Now, what will the manufacturer of equipment do? I think there might be one thing he could do. I think that he might give good advice, perhaps better advice than he does to the people who purchase his equipment, because not infrequently the equipment that is purchased to accomplish a particular job is not the right equipment, and it will not do the job.

There are certain activities in certain sales promotions whereby people find wider uses for better pieces of equipment by seeing that they are adapted for the purpose for which they are used; and if that is a useful suggestion I have no hesitation in proposing it.

Mr. Waidelich: I would just like to second the remarks of Mr. Ziel. It is very difficult to find enough space for the equipment that is required for an effective job of heating and ventilating in a large plant. There seems to be some reluctance on the part of the prospective owner to provide space in many cases. He cannot realize why so much space has to be allocated. As a result, compromises are attempted and the space is reduced with the inevitable result that eventually there is not enough space, and then everything from that stage on gets worse.

That is why we began to use truss space between the bottom chord of the truss and roof. This space is not generally used by the manufacturer. He does not seem to have too much objection to the use of the truss space. Its use is often a very happy solution to our problem.

There is sometimes difficulty in selection of equipment, and therefore in many cases manufacturers have been asked to design equipment for us that would fit into the spaces available. We have found that a much happier solution and one that pleases everyone is not to use penthouses and ground floor area, but to put as much of the equipment or all of it, if possible, in the space in the roof trusses.

Mr. Hunting: We sometimes erect our equipment on the floor on platforms, and then raise the platform up between the trusses. This system will work out well in the type of building referred to by Mr. Ziel, where there are large open areas of 1,000 ft or more by 200 ft or more, because by spacing these systems as required for the capacity of each unit, we can cover the entire area with very similar or identical units if your space conditions are the same. We advocate doing that even where some areas have different conditions, to as great an extent as feasible. We would isolate spaces to bring the atmospheric conditions to what were required in this one isolated space. I think that covers that part.

Chairman Witheridge: Thank you. Although I was supposed, as the program indicates, to summarize the symposium, our time is short and consequently I am not going to try to duplicate, even in a thumbnail fashion, what has been said today.

It seems apparent that much good can come from the additional effort all of us make to consult one another about our individual activities which converge in a single industrial environment, or a single industrial plant, or a single application. It is not possible to operate individually in this field without causing conflicts that are difficult to correct.

That really is the chief purpose of a symposium of this nature, to make it easier as each of us goes out into our individual activities to maintain and add further contacts with one another so that we help each other avoid the many mistakes that certainly have been made in the past. By those mistakes we learn how to do the job better for the future.

The Essex and Sussex with private beach directly in front

Warm Welcome to ASHVE Members for the Meeting-by-the-Sea

NEW JERSEY, the Garden State, though 45th in size among her 48 sister states, is eighth in population and ranks sixth in value of manufactured products. Yet it is no horizon of smokestacks. Over 40 percent of the state is farmland and there are thousands of acres of state parks and forests. Probably the most picturesque of the state's attractions are the scores of sun-drenched beaches extending 125 miles from Atlantic Highlands to Cape May. Among these Spring Lake, though not the most publicized, is one of the finest.

A wide, gently sloping beach, fascinating, mile long boardwalk, and the excellent accommodations of The Essex and Sussex Hotel, all combine to offer ASHVE members one of the finest opportunities for a meeting combined with a memorable family vacation.

The technical program will include three sessions and eleven papers will be presented. Among the subjects will be several papers on heat flow and heat transfer problems, including heat flow through glass; research in room air distribution; studies on physiological reactions to environment; and air filtering and air drying. The entertainment highlights include the golf tournament for the Research Cup and the Eichberg Memorial Trophy, the Semi-Annual Banquet, and a typical Atlantic Shore Dinner.

New Jersey is famed for its superb highway system, and with the recent completion of the New Jersey Turnpike, undoubtedly the finest superhighway yet built, north-south travelers are speeded on their way through some of the country's most densely populated areas at a 60 mile an hour non-stop speed. Society members coming to Spring Lake from the South using the Delaware Memorial Bridge and the Turnpike should exit at the Camden-Philadelphia Toll Gate and take New Jersey Highways S-41 and 40, or exit at the Hightstown-Trenton Toll Gate and take New Jersey Highways 33 and 34 to Spring Lake. From New England and New York via the George Washington Bridge or the Lincoln Tunnel, the Turnpike offers the fastest means of by-passing the New Jersey industrial complex of Newark, Jersey City, and Elizabeth. Otherwise, members should use U.S. Route 1 (the Pulaski Skyway). Both roads have exits at N.J. 4 (the Garden State Parkway) which leads to N.J. 34 to Spring Lake.

The New Jersey members of the New York Chapter are now preparing the final details of the program. Following each day's technical session there will be a variety of diversions for both members and ladies, such as golf, swimming, tennis, sightseeing and inspection trips.

Committee on Arrangements

F. H. Faust, *General Chairman*
H. P. Morehouse, *Vice Chairman*
Committee Chairmen
Banquet — W. A. Swain
Entertainment — R. D. Terhune
Finance — W. M. Heebner
Ladies — T. R. Peyrek
Publicity — P. B. Gordon
Reception — H. M. Rudio
Sessions — A. A. Bearman
Sports — L. G. Huggins
Transportation & Inspection — A. H. Moraweck, Jr.

PROGRAM — 1952 SEMI-ANNUAL MEETING

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

The Essex and Sussex, Spring Lake, N. J.

June 16-18, 1952

Sunday — June 15

10:00 a.m. Council Meeting
2:00 p.m. REGISTRATION
3:00 p.m. Committee on Research
4:00 p.m. Get-Together and Musicale
8:30 p.m. Movies

Monday — June 16

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION
- Experimental Data on Drying Atmospheric Air for a Supersonic Wind Tunnel, by W. E. Emley, Jr.
- Quantitative Treatment of Dust Measurement by Discoloration Method, by A. B. Hubbard
- Effectiveness and Temperature Requirements for Cooling Panels Removing Internal Radiation, by Merl Baker

11:00 a.m. Ladies Bus and Boat Trip to New York City
12:15 p.m. Welcome Luncheon
1:30 p.m. Golf Tournament — Research Cup and Eichberg Memorial Trophy
Inspection and Sightseeing Trips
Fishing — Swimming
2:00 p.m. Ladies Card Party and Entertainment
8:30 p.m. Dancing and Entertainment

Tuesday — June 17

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION
- Moisture Migration in a Guarded Hot Plate, by N. B. Hutcheon and J. A. Paxton
- Cooling Load from Sunlit Glass, by C. O. Mackey and N. R. Gay
- A Study of Transient Heat Method for Measuring Thermal Conductivity, by D. D'Eustachio and R. E. Schreiner
- *A Low-Inertia Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum, and G. V. Parmelee

12:15 p.m. Clam Bake and Beach Party
2:30 p.m. Nominating Committee
8:30 p.m. Music and Dancing

Wednesday — June 18

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION — Research Session
- Outlet Turbulence Intensity as a Factor in Isothermal-Jet Flow, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza
- Exploration of a Chilled Jet, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza
- The Shading of Sunlit Glass — An Analysis of the Effect of Uniformly Spaced Flat Opaque Slats, by G. V. Parmelee and W. W. Aubele
- *A Smoke-Filament Technique for Experimental Research in Room Air Distribution, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza

10:00 a.m. Ladies Sightseeing Trip to Atlantic Highlands
1:30 p.m. Inspection and Sightseeing Trips
2:00 p.m. Ladies Tea and Card Party
7:00 p.m. Semi-Annual Banquet

*To be presented by title.

Method of Choosing Location of, Financing and Conducting Meetings of the Society

Resolved: That inasmuch as the Annual and Semi-Annual Meetings of the Society come under the jurisdiction of the Council, the following rules governing the handling of such meetings be adopted by the Council and published in the JOURNAL of the Society at least twice during every year, preferably just prior to each meeting.

1—The Council will select the city in which the Annual or Semi-Annual Meeting is to be held, giving due consideration to the invitations received from Chapters or members as well as to the advisability of so distributing those meetings as to make them of the greatest advantage to the general membership, and to reduce as far as possible the expense of members attending.
2—That an appropriation be made to cover the entertainment or local expenses, incurred in connection with the meeting, and the regular meeting expenses to be taken care of by the General Fund of the Society in the regular way.
3—That no registration fee or compulsory obligations of any nature be imposed on members or guests.
4—That the purchase of tickets for banquets or for any other form of entertainment that may be provided be entirely voluntary.
5—That the grouping of features and the sale of tickets for group features be discouraged.
6—That the raising of funds from manufacturers of heating apparatus be discouraged.
7—That the display of samples, or of literature, advertising the product of any manufacturer in any way, shape or form, be not permitted at the booths, registration desk, or in or about the meetings.
8—That the distribution of trade papers be entirely at the discretion of the committee in charge.
9—That the local Chapter or local members be empowered to form a General Committee with such sub-committees as may be required to handle the details of transportation, hotel accommodations, entertainment, finance, etc., and that this General Committee be requested to confer frequently with the Council, through the Executive Secretary of the Society, and to make frequent reports on progress in connection with the various matters being handled by them.
10—That the arrangements of elaborate and costly entertainment features be discouraged.

Adopted at Council Meeting, January 29, 1926.

ASTM CELEBRATES 50TH ANNIVERSARY

Incorporated in Pennsylvania in 1902, the *American Society for Testing Materials* will observe its golden jubilee in conjunction with the 50th Annual Meeting to be held in New York on June 23-27, 1952. The *ASTM* has concentrated its work on the promotion of knowledge of the materials of engineering and the standardization of specifications and the methods of testing. Incorporated by seven men, among them two business men, two consulting and testing engineers and three professors, the Society has grown to 7,200 members today, of which 1,800 are companies and associations. Currently, there are at least 2,000 main committees, sections and related sub-groups, ranging from Steel to Textile Materials to Petroleum Products.

The *ASTM* joined with the Founder Societies to establish the *American Standards Association* in 1918, founded to coordinate the work of standardization and prevent duplication of effort. The ASHVE is an associate member of *ASA*, and many ASHVE members serve on the various *ASTM* standards committees.

The Society standards are in use today by hundreds of companies either directly or by incorporation of *ASTM* specifications into their company standards. Some idea of the growth of the Society's work can be grasped by the fact that in 1917 there were 133 *ASTM* standards, while in December, 1940, there were 952 standards and tests available. Today there are 1,850 tests and standards and the 1952 book of *ASTM Standards* will aggregate some 10,000 pages in seven parts. On their 50th Anniversary, the *ASTM* can look back on a half-century of useful achievements.

As an aid to the Office of Defense Mobilization in carrying out its objectives, the *ASTM* has been requested to develop methods of conservation of scarce materials, through the use of substitute materials or through more efficient use of materials.

The dates for the *ASTM* 1953 annual meeting have just been announced as June 29 to July 3. It will be held at the Chalfonte-Haddon Hall, Atlantic City, N. J.

ENGINEERING SHORTAGE

At a press conference of the *Engineers Joint Council* held recently at the Engineers Club of New York, T. A. Marshall, Jr., executive secretary of the *Engineering Manpower Commission* of the Council, called attention to the shortage of engineers as the current number one problem of the United States. He stated that every secondary school in the United States will receive a four color poster designed to help alleviate the critical shortage of engineers by urging students to consider the opportunities in this profession.

The conference was highlighted when A. G. Clausen, Jr., president of the New York City Board of Education, received the first of these posters from Mr. Marshall, who pointed out that the high school program to recruit new engineers was just one of the many solutions offered by the *Engineering Manpower Commission* to alleviate the shortage, and that other solutions rested with the Department of Defense and industry. He called for top utilization of every engineer whether he be in the service, in the government, or in civilian industry. He also brought out the fact that about 30,000 engineers would be *needed* annually to make ends meet. According to present enrollments, he stated, a scant 15,000 to 17,000 per year graduating from engineering colleges for the coming years, is the forecast.

Mr. Marshall closed his remarks by saying that in this world struggle, whether it is cold war or hot war, the western world is hopelessly out-numbered. Therefore, he asserted, we must look for defense from our engineering and scientific superiority, and if we lose that, we lose our freedom. He added that a national program is now in effect which is aimed at parents of secondary school children and stresses the importance of impressing upon them that the national economy depends on a volume of additional engineering talent.

Personal Notes

The appointment of J. C. Davidson, Minneapolis, as assistant manager of application engineering of the Airtemp Division of Chrysler Corp. was announced recently by J. F. Knoff, general sales manager.

Mr. Davidson joined Chrysler as a field engineer in the Minneapolis region and has held that position until his present appointment. He is a graduate of the University of Minnesota, a registered professional mechanical engineer, and a member of ASHVE.

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J. H. Jennings, Chicago, has been named chief engineer of the room air conditioner division of Servel, Inc., Evansville, Ind., according to an announcement by W. P. Jones, president.

Mr. Jennings, a native of Chicago, attended Onarga Military School, Onarga, Ill., and the Utilities Engineering Institute, Chicago. Later he took advanced work at the University of Illinois and the University of Chicago. He is a registered professional engineer in the State of Illinois. A member of ASHVE, he is also a member of *ASRE*, and the *Society of American Military Engineers*.

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H. C. Pierce, Evansville, Ind., assistant sales manager of the Air Conditioning Division, Servel, Inc., has been elected chairman of the newly organized engineering committee of the residential air conditioning section of the *Air Conditioning and Refrigerating Machinery Association*, which includes all principal air conditioning manufacturers. The objective of this committee is to establish application engineering standards on residential air conditioning for the entire industry.

A native of Shelby, Mich., Mr. Pierce attended Michigan State College and the University of Michigan. He joined Servel as an air conditioning sales engineer in 1940. A member of ASHVE, he has served on important committees of the *ASRE* and *AGA*.

Summary of Chapter Meetings

ST. LOUIS CHAPTER MEMBERS INSPECT INDUSTRIAL PLANT

A tour through the Kennard Corp. Plant, St. Louis, Mo., beginning at 6:00 p.m. was the feature of the Chapter's February 12, 1952 meeting. A total of 140 members and guests made the tour, which was both interesting and well conducted. Representatives of the corporation were on hand to demonstrate the operation of the machines and the various steps involved in producing coils, units, and evaporative condensers.

At the end of the tour the group was served a delightful buffet supper as guests of the corporation.

F. W. McKenna of Kennard Corp., spoke on the subject, *Principles of Testing and Rating Air Conditioning Coils*. Mr. McKenna used slides to demonstrate the equipment and methods employed for testing coils. Following the talk, the entire group was invited to visit the laboratory to see a coil test set-up in operation.

Pres. L. L. Hamig was the presiding officer at the business meeting; and J. F. Naylor, Jr., read the resolutions adopted at the Annual Meeting, expressing the Society's gratitude and thanks to the St. Louis Chapter, its officers and committees, and to all other organizations and individuals responsible for the success of the 58th Annual Meeting. The following were appointed to serve on the Chapter's nominating committee: J. S. Rosebrough, J. W. Cooper, C. E. Hartwein, J. H. Carter and L.W. Moon. C. H. Burnap, chairman of the meetings committee, announced that the next meeting would be a joint meeting with the *ASRE*, with dinner at the Melbourne Hotel and the meeting at the Engineers Club.

A rising vote of thanks was extended to the Kennard Corp. for their wonderful hospitality and the interesting program provided.

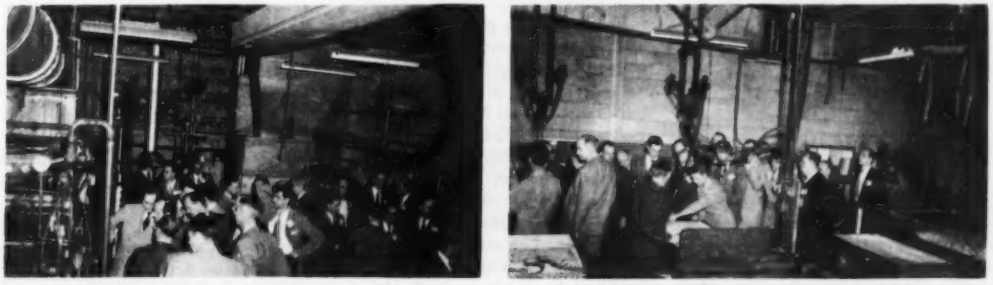
COOLING PANELS FEATURED, ILLINOIS CHAPTER MEETING

For many air conditioning design conditions, properly applied cooling panels can handle about half of the total cooling load, A. T. Jorn, chief development engineer, Architectural Products Division, Burgess-Manning Co., Libertyville, Ill., told the Illinois Chapter members at their February 11 meeting. He said that panel heating and cooling should be considered together, for a panel is seldom used for cooling only.

Some advantages of panel cooling, according to Mr. Jorn, include a substantial reduction in the load to be handled by the air conditioning system so that smaller ducts may be used with consequent space saving, a reduction in the room mean radiant temperature so that higher air temperatures may be carried, a reduction of drafts within a room because air quantities have been reduced and an increase in the temperature tolerance of the occupants from approximately 2 to 6 deg (that is, permissible temperature variation before perception of a change in temperature occurs).

In the opinion of the speaker, the ceiling surface of a room is the only suitable location for a panel which will be used for both heating and cooling. Under many summer conditions, an ordinary ceiling acts as a heating panel because it absorbs heat from lights and heat which enters the room through glass areas.

In regard to condensation problems, Mr. Jorn pointed out that the latent heat load, or more specifically, the dewpoint of the room air, limits the cooling panel temperature which may be used. He stated that panel



St. Louis Chapter members on a conducted inspection tour of industrial plant at Chapter's February 12 meeting

A. T. Jorn
Libertyville, Ill.

temperatures of 70 to 80 F may be used where there is no dehumidification. Lower temperatures, he explained, may be used where dehumidification lowers the dewpoint of the air.

The meeting was called to order by Pres. G. W. Bornquist at 7:45 p.m., following dinner, in the Merchants & Manufacturers Club, Chicago. The total attendance at the meeting reached 141, including 67 guests.

• *ATLANTA*—February 11, 1952. Pres. F. A. Player called the meeting to order in the Harris Tea Room, following a social hour and dinner. The minutes of the previous meeting were read and approved; and President Player reported on the activities at the Annual Meeting in St. Louis in January.

C. B. Cole introduced the speaker of the evening, J. J. Casper, of the Federal Bureau of Investigation. Mr. Casper gave an interesting talk covering the work of the FBI, and including the selection, training and duties of its agents. The meeting adjourned at 9:15 p.m. Attendance 24.

•*ATLANTA*—January 14, 1952. The usual social hour and dinner preceded the business meeting, which was called to order by Vice Pres. J. G. Croley, presiding in the absence of Pres. F. A. Player.

The first part of the program was devoted to the showing of films depicting the highlights of the 1951 Georgia Tech football season. Following the presentation of the films, Lamar Wheat, captain of the Georgia Tech team, answered questions from the audience regarding many of the past season's plays.

Judge Bond Almand, of the Georgia Supreme Court, was introduced by J. S. Edgar as the speaker of the evening. Judge Almand spoke on *Independent States, Quo Vadis*, tracing the evolution of the American governmental system from its inception as a union of independent states to the present highly centralized federal government. Attendance 41.

• *BALTIMORE*—March 19, 1952. Following the social hour and dinner, the meeting was called to order by Pres. W. P. Flanigan. The first order of business was the election of the following nominating committee: E. J. Morris, chairman, G. B. Priester, E. L. Crosby, W. P. Flanigan and E. H. Taze.

J. S. McCollam, York Corp., spoke on *Hotel Air Conditioning* and briefly traced the development of air conditioning in this field beginning with the use of ammonia and carbon dioxide refrigerants in the early 1930's and later dichlorodifluoromethane.

He then discussed the various means of conditioning guest rooms, with self-contained units, fan units with a central chilled water system, and high pressure induction units with central refrigeration.

Mr. McCollam explained that hotels have many varying requirements, since they usually house such places as coffee shops, drug stores, beauty parlors, as well as function and guest rooms. Mr. McCollam dealt only in general terms with the question of costs on the many types of systems, explaining that each installation would vary considerably in cost.

Mr. McCollam also predicted that air sterilization would receive greater attention by engineers in the future. Attendance 48. Attendance ratio 0.47.*

• *BALTIMORE*—February 20, 1952. A social hour and dinner preceded the business meeting, which was called to order at 8:40 p.m. in the Engineers Club. Attention was called to the Engineers Club Oyster Roast, to be held on March 1, and the I-B-R School, to be conducted March 16 through 18 at the Fifth Regiment Armory. The members were advised that E. L. Crosby, Baltimore Chapter's first president, was appointed on the Society's Nominating Committee and chairman of the Charter and By-Laws Committee. A detailed report on the activities at the St. Louis Meeting, by F. M. Hewitt, Chapter secretary, followed.

The speaker of the evening, P. L. Davidson, consulting engineer from Philadelphia, Pa., spoke on *Air Conditioning of the Textile Industry in the South*. Mr. Davidson traced the development of air conditioning in the textile industry, beginning with wet floors, sprays, and steam distribution; spray and forced ventilation as introduced in the principles of Carrier in 1911; the air washer and saturated air with an atomizer. The pros and cons of unit or central station systems were discussed, particularly in regard to the flexibilities that have to be included in any textile mill air conditioning set-up. A discussion concerning the cleanliness of the air indicated that electrostatic filters were economically justified in the reduction of grading of material due to smoke and soot. Windows in construction design were indicated by the speaker to be undesirable in that they do not fill their intended purposes of light and ventilation and several members disagreed with this contention. It was indicated that thermal characteristics in the design of walls were unimportant; however, with the high humidity in textile mills, provision must be made for

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

the prevention of condensation within walls which could rot them. Mr. Davidson further discussed lighting and refrigeration, indicating that the latter should not be legislated because in most cases air conditioning justifies its use in improved working conditions and effective quality control. A summation of the talk indicated that most of the principles which apply to textile mills also apply to most industrial plants. Attendance 51. Attendance ratio 0.47.

• *CENTRAL NEW YORK*—March 26, 1952. Pres. J. H. Carpenter called the meeting to order at 8:00 p.m. at Henry Moran's Restaurant, Syracuse, N. Y. The introduction of members and guests was followed by the reading and approval of the minutes of the previous meeting and the treasurer's report.

G. W. Meek, consulting engineer from New York, N. Y., spoke on *Of What Interest is Odor to Air Conditioning Engineers.* A question and answer period followed the talk. Attendance 52.

• *CENTRAL NEW YORK*—February 27, 1952. The meeting was called to order by Pres. J. H. Carpenter in the University Club, and self-introduction of members and guests followed. The minutes of the previous meeting and the treasurer's report were read and approved. F. E. Krell, Central New York Chapter's member on the Chapters Conference Committee, reported on the meeting held by that committee in St. Louis at the Annual Meeting.

The speaker of the evening was J. W. James, vice president in charge of research, McDonnell & Miller, Inc., Chicago, Ill., who spoke on *Operating Characteristics of Hot Water Systems.* Mr. James traced the development of hot water heating systems from the hand-fired, gravity circulated, low temperature, open systems, with cast-iron radiators, to automatically-fired, high-temperature, pump-circulated, closed systems. An

John W. James
Chicago, Ill.

interesting question and answer period followed the talk. Attendance 58. Attendance ratio 0.31.

• *CENTRAL NEW YORK*—January 23, 1952. The feature of the January meeting, held in the University Club, Syracuse, was a symposium on the subject, *How Would I Heat My Home,* with Chapter member, C. R. Acheson, consulting engineer, acting as moderator. The speakers were: W. E. Hood, Carrier Corp., W. J. Morrow, Syracuse Heating Supply, both of Syracuse, and L. J. LaTart, Revere Copper and Brass, Rome, N. Y. Mr. Hood spoke on the advantages of warm air heating; Mr. Morrow spoke on the advantages of baseboard type heating with circulated hot water as the medium; while Mr. LaTart enumerated the desirable characteristics of radiant panel heating with imbedded hot water coils. Attendance 106. Attendance ratio 0.47.

• *CENTRAL OHIO*—February 18, 1952. Pres. R. S. Curl called the meeting to order at 8:00 p.m. in the Grandview Inn. The treasurer made a report on the Chapter's total membership; and President Curl, Central Ohio Chapter's alternate on the Chapters Conference Committee, gave a complete report on the St. Louis Meeting. R. A. Wilson, chairman of the television committee, reported on the program being sponsored by the *Columbus Technical Council.* Mr. Wilson outlined the activities of the Council in its effort to get the Franklin County Board of Education to rearrange the curriculum of the high schools, so that students would be better qualified, that is, have the correct background and the necessary school credits, to enter engineering colleges.

The speaker of the evening was M. R. Eastin, sales manager, Railway Controls Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Mr. Eastin gave an excellent talk on electronic controls and their application in various types of heating and air conditioning systems, other than commercial and residential. Attendance 40. Attendance ratio 0.39.

• *CINCINNATI*—March 4, 1952. Pres. J. J. Bechtol called the meeting to order at 7:45 p.m., and the reading and approval of the minutes of the previous meeting followed. Pinkney Varble, chairman of the entertainment committee, reported on plans for the 20th Anniversary Dinner-Dance to be held on March 8 at the Cincinnati Club. President Bechtol reported on the Annual Meeting in St. Louis, particularly the proceedings at the Chapter's Conference Committee meeting. E. W. McNamee, chairman of the nominating committee, presented the committee's recommendations for nominees for 1952 officers; and Secretary R. C. Beineke announced that six new members had joined the Chapter.

The feature of the evening was a panel discussion on *Current Heating and Ventilating Problems,* with B. R. Byard, owner, B. R. Byard Co., Cincinnati, as moderator. The panel was comprised of the following Chapter members: A. H. Gerdsen, president, The A. H. Gerdsen Co.; E. J. Kramer, manager of the Heating Department, The Cincinnati Supply Co.; and R. C. Beineke, engineer, Fosdick and Hilmer, consulting engineers, all of Cincinnati. Attendance 44. Attendance ratio 0.35.

• *DELTA*—March 11, 1952. The meeting was called to order by Pres. Theodore Offner in the Trophy Room of the New Orleans Athletic Club, and members introduced themselves and their guests. The minutes of the

February meeting were read and approved; and it was voted to hold the Annual Chapter Party in the Stein Room on July 7 and to extend an invitation to *ASRE* members and their wives. C. V. Bankston presented the financial report; and announcements were made concerning the forthcoming Semi-Annual Meeting in Spring Lake, N.J., in June and the 7th Oregon State Air Conditioning Conference, April 10-12.

L. R. Maxwell introduced the speaker of the evening, W. W. Higgins, who spoke on *Engineering and Manufacture of Glass-Coated Products*. Attendance 35. Attendance ratio 0.30.

• *DELTA*—February 12, 1952. Pres. Theodore Offner called the meeting to order in the Trophy Room of the New Orleans Athletic Club, and in the absence of H. L. Salaun, secretary, appointed T. J. Jenny as acting secretary. The minutes were read and approved; and the treasurer,

Dr. R. C. Jordan
Minneapolis, Minn.

C. V. Bankston, submitted his report. J. S. Burke and Walter Cooke, member and alternate member of the Chapters Conference Committee, reported on the St. Louis Meeting, and it was announced that C. B. Gamble had been re-elected to the Society's Nominating Committee, and this year was serving as its secretary.

Mr. Burke introduced the speaker of the evening, Dr. R. C. Jordan, head, Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minn., who spoke on the subject, *Heat Sources and the Heat Pump*. Attendance 41. Attendance ratio 0.34.

• *IOWA*—March 11, 1952. Pres. C. H. McGuiness called the meeting to order at 8:00 p.m. in the Standard Club, Des Moines, and the minutes of the February meeting were read and approved. After considerable discussion, it was voted that a permanent member be appointed on the Chapters Conference Committee to represent the Chapter at the Society's Annual and Semi-Annual Meetings. The board of governors was instructed to present their recommendations of members qualified and willing to serve in that capacity at the May meeting. It was further agreed that the current Chapter president would serve as the alternate member.

President McGuiness expressed a desire to bring the Chapter by-laws up to date, and he asked the members to study the by-laws and make any suggestions regarding either changes or additions to the board of governors. The board was instructed to study the by-laws and make its recommendations at the next meeting, taking into consideration the members' suggestions.

Following a brief intermission, the program chairman introduced Don Bloomquist, Refrigeration Department, The Trane Co., LaCrosse, Wis., who presented an illustrated talk entitled *New Concepts of Compressor Design*. The talk covered the development of the 40-ton reciprocating compressor and a new hermetic, centrifugal refrigeration unit. Mr. Bloomquist brought out, what he termed, the advantages of the new unit as follows: (1) efficiency; (2) reliability; (3) low cost, obtained through such features as interchangeable parts, cast rather than forged crank shafts using nodular cast iron; (4) compactness and light weight, achieved by using aluminum alloy connecting rods, therefore, eliminating babbit bearings; (5) smooth performance, insured by specialized design for protection against liquid slugs, high speed operation and careful balance of crankshaft; and (6) serviceability, obtained through a minimum number of internal bolts, complete sub-assemblies, acceptability and interchangeability of parts. Attendance 31. Attendance ratio 0.42.

• *KANSAS*—February 5, 1952. A social hour and dinner at Wolf's Cafeteria preceded the business meeting, which Pres. R. F. Bauer called to order at 8:00 p.m. The minutes of the previous meeting were read and approved; and H. L. Stevens, chairman of the legislative committee, advised that the Chapter would operate under the Society By-Laws until the Kansas Chapter by-laws were for-

C. F. Boester
W. Lafayette, Ind.

mally approved. The meeting was turned over to O. P. Bullock, Kansas Chapter representative on the Chapters Conference Committee, who reported briefly on the Annual Meeting in St. Louis. It was announced that a detailed mimeographed report would be sent to each member.

Mr. Bullock then introduced the speaker of the evening, C. F. Boester, housing consultant, Purdue Research Foundation, Purdue University, West Lafayette, Ind., who made some brief remarks in behalf of promoting Chapter members' interest in Society activities.

In speaking on his topic, *Reflective Radiant Heating and Cooling*, Mr. Boester covered the past, present and future history in this particular type of heat transfer. He stated that research in this field had led to some fantastic-sounding findings, but nevertheless, it would be possible in the future to be comfortable in a home with a temperature of from 5 to 10 deg below zero. He added that this would be accomplished by having wall surfaces which reflect all heat waves. Attendance 27. Attendance ratio 0.27.

• *KANSAS CITY*—March 3, 1952. Following a social hour and dinner in the Wishbone Restaurant, Kansas

City, Mo., Pres. C. W. Schumacher called the meeting to order at 8:10 p.m. Members and guests identified themselves and the minutes of the February meeting were read and approved.

The feature of the evening was an address on *Operating Characteristics of Hot Water Systems*, by J. W. James, vice president in charge of research, McDonnell & Miller, Inc., Chicago, Ill. Mr. James' talk traced the gradual development of hot water heating from the old gravity type systems with large pipe sizes and open expansion tanks to the modern, automatically-controlled, forced-circulation system with small pipe sizes and closed expansion tanks. He placed special emphasis on operational problems associated with increased temperatures and pressures and maintenance of proper continuous circulation. Attendance 31. Attendance ratio 0.14.

• *MANITOBA*—February 21, 1952. Pres. J. F. Bertram called the meeting to order; and the minutes of the previous meeting were read and approved. W. J. Atkinson, Chapter vice president and Manitoba Chapter member on the Chapters Conference Committee, submitted a report on the Annual Meeting in St. Louis. President Bertram announced that Chapter member, J. F. Allingham, was transferring to the Toronto Chapter. Mr. Allingham offered to convey the Manitoba Chapter's greetings to the Toronto Chapter.

C. M. Fleming introduced the speaker of the evening, V. Dale Wissmiller, supervisor, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., who gave a very interesting, illustrated talk on the elementaries of electronics and the application to controls. Attendance 31.

• *MASSACHUSETTS*—March 18, 1952. Following a social hour and dinner in the Campus Room of the MIT Graduate House, Pres. John Bonner called the meeting to order.

Vice Pres. G. B. Torrens introduced R. S. Tobin, chairman and technical representative, New England Chapter, *National Certified Pipe Welding Bureau*. Mr. Tobin's topic was *Certified Pipe Welding*, and he told of the Bureau's history and explained its methods of operation. He emphasized the importance of using the standard specifications set up by the Bureau in order that owners, architects, and engineers might be assured of good pipe welding results. Attendance 38.

• *MASSACHUSETTS*—February 19, 1952. The feature of the evening was a talk on the subject, *Cooling Towers, Design and Construction*, given by A. G. Stacy, chief engineer, Binks Manufacturing Co., Chicago, Ill. Mr. Stacy's talk was interesting and well received and was followed by an informative question and answer period.

Pres. John Bonner called the meeting to order, following a social hour and dinner in the Campus Room of the MIT Graduate House. Attendance 31.

• *MIAMI VALLEY*—February 7, 1952. Pres. C. D. Weaver opened the meeting, following dinner at Neil's Restaurant, and the minutes of the previous meeting were read and approved. President Weaver made a report on his attendance at the Annual Meeting in St. Louis, and the treasurer's report was submitted.

The speaker of the evening was O. J. Prentice, C. A. Dunham Co., Chicago, Ill., who spoke on *Heating and National Defense*. Mr. Prentice stated that heating and ventilating will play an important role in civil defense since the best shelters are the basement areas in our large buildings. Therefore, if it should be necessary for large numbers of people to gather in these basements, proper ventilation and heating will be required to maintain healthful conditions.

O. J. Prentice
Chicago, Ill.

The remainder of the talk emphasized the importance of civil defense to the national welfare, and Mr. Prentice urged a greater interest and more active part in the Civil Defense program by all. Attendance 20.

• *MICHIGAN*—March 17, 1952. A talk on *Research in Panel Heating*, given by P. B. Gordon, vice president, Wolff and Munier, Inc., New York, N. Y., was the feature of the meeting. Mr. Gordon gave a comprehensive report on the work being accomplished by the Society's Research Laboratory and various colleges and universities in cooperation with the Laboratory. He explained that the fundamental purpose of the program is to develop standards and standard data for testing, and he added that most of this work is being done at the Laboratory.

Speaking more specifically, Mr. Gordon stated that a study of temperature control as applied to panel heating is being carried on as a cooperative project at the University of Minnesota. He pointed out that much of the data compiled have already been used practically in THE GUIDE.

According to the secretary's report, the talk was most interesting and a rising vote of thanks was extended the speaker.

The meeting was called to order by Pres. G. W. Akers in the Engineering Society of Detroit headquarters, following a social hour and dinner. Attendance 105.

• *MINNESOTA*—March 3, 1952. Pres. E. F. Snyder, Jr., called the meeting to order in the Dyckman Hotel, and the minutes of the February meeting were read and approved. L. C. Gross, chairman of the nominating committee, sub-

mitted the names of nominees for 1952 officers. A letter was read from Executive Secretary A. V. Hutchinson stating that the candidates for membership would be published geographically in the JOURNAL, beginning with the March issue; and mention was also made of the forthcoming Semi-Annual Meeting in Spring Lake, N.J., June 16-18. It was announced that at the May meeting the past president's emblems for the last three presidents would be presented and new officers would be installed.

H. W. Heisterkamp, manager, Dehumidifier Division, Bryant Heater Co., Cleveland, Ohio, spoke on *Moisture Problems and Their Solution*. A question and answer period followed the talk. Attendance 98.

• *MINNESOTA*—February 3, 1952. The meeting was called to order by Pres. E. F. Snyder, Jr., in the Robin Hood Room of the Dyckman Hotel. The minutes of the December and January meetings were read and approved, and the guests were introduced. President Snyder gave a detailed account of his attendance at the Society's Annual Meeting in St. Louis and called attention to the fact that the Minnesota Chapter had 40 members in attendance, topped only by the Illinois Chapter. A discussion was held regarding means of obtaining new members for the Society.

Vice President William Sturm introduced M. L. Hoglund, of the Trane Co., La Crosse, Wis., who spoke on *New Concepts in Compressor Design*. Attendance 83.

• *MINNESOTA*—January 14, 1952. The annual joint meeting of the Minnesota Chapter with the Twin City Section of the *American Society of Refrigerating Engineers* was held in the Robin Hood Room of the Dyckman Hotel. This year ASHVE was the *ASRE's* guests.

R. W. Ayres, *ASRE* Section chairman, opened the meeting; and the only business conducted was the selection of the following nominating committee by ASHVE: L. C. Gross, William McNamara, E. A. Monies, C. E. Hausman, and D. B. Anderson.

Dean A. F. Spilhaus, of the Institute of Technology of the University of Minnesota, Minneapolis, Minn., spoke on the aims and objectives of the Institute. Attendance 103.

• *NEBRASKA*—March 11, 1952. Members and guests met for a social hour and dinner, after which Pres. K. E. Martin called the meeting to order at 7:30 p.m. It was announced that F. S. Farkas had driven down from Sioux City, Ia., to attend the meeting, and had brought along a guest. Members were advised that Pres. Ernest Szekely would be the Chapter's guest at the May meeting and that the June meeting would be in the form of a spring party to which the ladies were to be invited.

J. D. Pierce, chief engineer, The Vulcan Radiator Co., Hartford, Conn., gave an interesting, illustrated talk based on comparative costs of one- and two-pipe forced hot water systems using fin tube radiation at 215 and 160 F with a forced warm air system. Mr. Pierce based his talk on information he obtained from actual bids received in Hartford; and the question and answer period produced some very interesting information on how prices that ran so close in Hartford varied considerably in Omaha. Attendance 31.

• *NEW YORK*—March 17, 1952. Members and guests met for a social hour and dinner in the Building Trades Club, New York, N. Y. The business meeting was called to order by Pres. Ernst Graber, and the minutes of the previous meeting were read and approved. In the absence of the membership chairman, Carl Flink, secretary, submitted the names of four new Chapter members: H. J. Campbell, Jr., J. L. Page, J. T. Falk, and A. D. Walker, Jr. President Graber paid tribute to F. E. W. Beebe, Life Member and New York Chapter treasurer from 1922 to 1932, who died on March 3.

D. J. Whealton, program chairman, introduced S. W. Brown, chief engineer, Marine Department, Carrier Corp., New York, N.Y., who described the equipping of a U. S. luxury liner of the Matson Line with complete air conditioning. By means of slides he showed the problems which were met and solved in regard to space saving, and exhibited the compactness of the apparatus installed. He stated that by using special horizontal air conditioning units, supplied by hot water at two temperatures, and by mixing the two streams desired, temperatures could be maintained by individual thermostats and automatic mixing valves. For cooling, the air supplied was cooled at a central station but passengers could adjust or shut off the air as desired.

Mr. Brown stated that the first cruise of the ship from Los Angeles to Hawaii demonstrated the adequacy of the air conditioning equipment to meet all conditions encountered. Attendance 130. Attendance ratio 0.21.

• *NORTH CAROLINA*—February 29, 1952. Following a social hour and dinner, Pres. L. L. Vaughan called the meeting to order at Bliss' Restaurant, Greensboro, N. C. The minutes of the board of governors meeting, held on January 14 at the Robert E. Lee Hotel in Winston-Salem, were read and approved.

Under the authority given by Council for the division of the North Carolina Chapter, resolutions were passed authorizing J. W. Bunn, Jr., to serve as temporary chairman of the Northern Piedmont Chapter and R. M. Warren to serve as temporary chairman of the Southern Piedmont Chapter, and that each temporary chairman be empowered to appoint the required committees to establish two new organizations to succeed the North Carolina Chapter.

• *NORTHERN OHIO*—March 10, 1952. Pres. John Richmond called the meeting to order at 8:15 p.m. in the Warner Auditorium of the Cleveland Engineering Societies building. The minutes of the previous meeting were read and approved with a slight

correction, and Vice Pres. R. E. Sherman announced that the Chapter Roster had been mailed to all members. President Richmond announced the receipt of an invitation from A. V. Hutchinson, executive secretary, to attend the forthcoming Semi-Annual Meeting in Spring Lake, N.J., June 16-18. President Richmond announced that a nominating committee would be selected at the April meeting.

The speaker of the evening, L. S. Cochran, vice president in charge of sales, Lockport Cotton Batting Co., Lockport, N.Y., was introduced by President Richmond. Mr. Cochran stated that greater comfort and greater economy are the two major factors a layman considers when insulating his home. He went on to enumerate some of the advantages of insulation, including such items as, (1) its elimination of dust streaking, thereby reducing redecorating costs, (2) its use as a fire preventive, (3) its use in acoustic treatment and (4) its main function, reducing heat flow. Mr. Cochran referred to a publication of the *University of Illinois Small Homes Council*, which mentions the relative advantages of insulation, weatherstripping, and storm windows and doors. He closed his talk emphasizing the importance of properly installing insulation.

Preceding the business meeting, Mr. Starner, representing the Bureau of Old Age and Survivors Insurance of the Federal Security Agency, reviewed the benefits of the former and the newly amended Social Security Law. Attendance 25. Attendance ratio 0.12.

• *ONTARIO*—March 7, 1952. The meeting was called to order by Pres. William Philip in the Royal York Hotel. President Philip introduced new Chapter members; and the meeting was turned over to F. D. Ledgett, who spoke on the need for increasing the Chapter membership. The nominees for 1952 officers, as selected by the nominating committee, were announced as follows: *president*—J. H. Ross; *vice president*—N. W. Kingsland; *secretary-treasurer*—H. R. Roth; and *board of governors*—M. C. Bailey, D. L. Angus, and William Philip, *ex-officio*. It was also announced that a third member on the board of governors was to be selected from the following names: G. S. McKernan, C. J. Bootes, and Ernest Fox.

H. G. S. Murray, president of Murray Air Conditioning, Ltd., Toronto, spoke on *Industrial Air Conditioning*. Attendance 105. Attendance ratio 0.43.

• *PACIFIC NORTHWEST*—February 12, 1952. Following an enjoyable social hour and dinner, Pres. R. M. Stern called the meeting to order at 7:45 p.m.

The meeting was then turned over to W. B. Pride, program chairman, who introduced Officer Freeman, of the Washington State Patrol. Officer Freeman, in the interest of the safety move to cut down on the growing toll of life and property damage, presented original tape recordings of numerous traffic violators.

Ralph Werner, chief automatic engineer for the United Parcel Delivery, spoke on *Possibilities of Internal Combustion Engines as a Heat Source*. Mr. Werner illustrated the method by which an internal combustion engine could be connected and used as a source of space heating at a minimum cost of equipment and fuel.

R. C. Lewis reported in detail on the St. Louis Meeting, and Secretary H. T. Orebaugh read a letter from the Puget Sound Naval Shipyard inviting the Chapter to be guests at Bremerton for the April meeting. Attendance 47.

• *PACIFIC NORTHWEST*—January 8, 1952. W. B. Pride, program chairman, called the meeting to order at 7:45 p.m. at the Engineers Club, in the absence of Pres. R. M. Stern. Members and guests were introduced, and the minutes of the previous meeting were read and approved.

A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif., spoke on *Air Conditioning and Its Effect on Plant Life*. Mr. Hess gave a complete description of an air conditioned greenhouse, which he designed completely from the air cooling and air distribution system to the filter system for fresh air. He stated that many tests were made with artificial lighting and temperature control to show that plants would grow faster during an extended artificial daylight period.

A discussion on the proposed new ventilating code followed, in which the membership took an active part; and it was the consensus of opinion that the code would have to be revised in its major portions. Attendance 51.

• *PHILADELPHIA*—March 13, 1952. The feature of the evening was an address on *The Ocean of Air*, given by G. L. Simpson, vice president and general manager, Pittsburgh Lectrodryer Corp., Pittsburgh, Pa. Mr. Simpson's talk was illustrated with specially prepared slides and reviewed the present knowledge of the ocean of air that extends up to the farthest reaches of the sky. He discussed what is known at present regarding the upper regions, temperatures, pressures, presence of ionizing layers and other factors which are concerned with supersonic flight and the paths of rockets.

Pres. M. E. Barnard called the meeting to order in the Engineers Club, Philadelphia, Pa. Attendance 65.

• *PITTSBURGH*—March 17, 1952. Pres. W. D. Simpson called the meeting to order, following dinner which was served at 6:45 p.m., in Webster Hall. B. B. Reilly program chairman, announced that C. M. Humphreys would be the speaker at the April 21 meeting, which would also be past president's night. C. L. Benn, treasurer, made his report; and President Simpson announced that the *ASME* was holding a spring conference, March 18 to 20, and had invited ASHVE members to attend.

The following were appointed to serve on the nominating committee: H. E. Park, chairman, L. S.

Maehling, and A. F. Metzger. An auditing committee was also appointed as follows: Edward Brusch, chairman, J. H. W. Cleland, and W. W. Johnson.

R. S. Dill, chief, Heating and Air Conditioning Section, National Bureau of Standards, Washington, D.C., spoke on *Research in Domestic Heating*. Mr. Dill outlined the programs being carried on at various colleges in domestic heating research. These programs include studies of solar heating, air cleaning, panel heating and perimeter heating. In Washington, the National Bureau of Standards is doing work along the same lines, testing various types of heating systems in their test bungalow. He indicated the location of the colleges engaged in home heating research, and pointed out the variety and complexity of the problems encountered in such studies. In Washington, condensation control in buildings is one of their primary objectives. A demonstration of the hot box for testing wall construction for heat loss and thermal conductivity was most interesting. Attendance 93.

• *SHREVEPORT*—March 20, 1952. Pres. R. M. Hood called the meeting to order in the Colonial Room of the Caddo Hotel. The minutes of the January and February meetings were read and approved, and the treasurer's report for 1951 was submitted and accepted. R. L. Patton's resignation as treasurer was accepted in view of the fact that Mr. Patton was moving to Dallas, and J. S. Malahy was elected new treasurer. President Hood made a brief report on the 58th Annual Meeting in St. Louis.

The speaker of the evening was V. F. Self, Anemostat Corp., New York, N. Y. Mr. Self discussed the various aspects of air distribution and diffusion, pointing out that this was a vital link between the occupant of the space and the equipment provided in any heating, ventilating, and air conditioning application. He added that unfortunately these aspects are frequently neglected. He then explained the principle of expansion-type air-diffusion equipment, illustrated by a short film which portrayed air movement to various types of air outlets with sulphur smoke. Attendance 33. Attendance ratio 0.77.

• *SHREVEPORT*—February 21, 1952. The meeting was called to order at 7:40 p.m. in the Colonial Room of the Caddo Hotel, with Pres. R. M. Hood presiding. The reading of the minutes was postponed until the March meeting in the absence of the secretary.

President Hood reported on the meeting of the planning committee for the Southwestern Air Conditioning Conference, which met at Texas A & M College. It was announced that the committee would meet again at Austin, Tex., with the National Bureau of Tropical Housing, to plan the Conference, which is scheduled for October. Thus far, it has been established that the first day of the Conference will be devoted to *Housing Construction* and part of the second day to *Heating and Ventilating*.

The speaker of the evening was Lamar Bain, M.D., who delivered an interesting address on *Human Comfort*. Attendance 13. Attendance ratio 0.38.

• *SOUTHERN CALIFORNIA*—March 4, 1952. Pres. M. C. Greiner called the meeting to order in the Carolina Pines Restaurant, Los Angeles; each person introduced the person to his right. Announcement of the Semi-Annual Meeting at Spring Lake, N.J., June 16-18, was made and those intending to attend were asked to contact President Greiner. Professor Eyre, University of Southern California's Mechanical Engineering Department, as well as a delegation of engineering students, were welcomed.

S. F. Duncan, research director, the Farr Co., Los Angeles, Calif., and formerly head of the Mechanical Engineering Department, University of Southern California, spoke on *Air Filtration*. In outlining the problems in air filtration, Mr. Duncan mentioned the classification of dusts, the samples required and testing methods. He then described typical dusts and their collection methods. Attendance 78. Attendance ratio 0.24.

• *SOUTHERN CALIFORNIA*—February 5, 1952. The meeting was called to order in the Carolina Pines Restaurant, Los Angeles; everyone was requested to introduce the person on his left. A. J. Hess, Southern California Chapter's representative on the Chapters Conference Committee, reported on his attendance at the Annual Meeting in St. Louis, and he also announced that he was elected to the Society's Nominating Committee. C. D. Walz, the treasurer, announced that not all members had paid the $3.00 mailing fee, and it was voted that notification be mailed to all those delinquent for the last two years stating they would be dropped from the mailing list.

V. J. Burke, program chairman, introduced the speaker of the evening, Commander T. J. Doyle, assistant public works officer at the U. S. Naval Test Station, Inyokern, located at China Lake, Calif. Commander Doyle stated that the station does research, test and development work and is approximately the size of Rhode Island with a population of over 12,000. The Public Works Department supplies the entire population with their needs as far as living maintenance and working quarters. It is in charge of over 1,400 vehicles, 4,000 buildings, and 50 miles of city and 50 miles of desert roads. Commander Doyle also stated that the Michaelson Laboratory has an installation in one building supplying 1,400,000 cfm and 1,400 tons of refrigeration for cooling.

The talk outlined the various problems arising on the base as a result of its desert character and explained the services required by the base from engineers and contractors. Attendance 93. Attendance ratio 0.47.

• *SOUTHWEST TEXAS*—February 19, 1952. Pres. W. E. Long called the meeting to order at the Bright Shawl, San Antonio; the minutes of

the January meeting were read and approved. The treasurer made his report; and D. E. Locher gave a report on the Society's Annual Meeting in St. Louis. President Long requested the help of the entire membership present in getting new members and getting existing members to attend meetings.

E. E. Cravens, sales engineer, J. R. Dowdell and Co., Houston, Tex., spoke on *Air Distribution Problems*, explaining the relationship between core area, free area and effective area, and grilles and round outlets. He illustrated the effects of changing grille bar deflection; he also discussed the subject of streaking or smudging, listing the causes as thermal precipitation, velocity precipitation and electrostatic precipitation.

Mr. Cravens explained the Bernoulli Theorum as applied to velocity pressure, static pressures, and total pressures in duct systems; and *air grabbers* were defined as means of converting velocity pressure to static pressure.

The application of the principles discussed was illustrated by a sample problem in duct design and outlet selection based on a hypothetical office building. Attendance 25.

• *SOUTHWEST TEXAS*—January 17, 1952. The meeting was called to order by Pres. W. E. Long at the Bright Shawl, San Antonio; the minutes of the November meeting were read and approved. President Long presented I. W. Wilke, the retiring president, with a past president's pin and congratulated Mr. Wilke on his successful year as president. E. E. Cravens, chairman of the auditing committee, reported that all Chapter accounts were found to be in order; and President Long then presented his selection of committee chairmen and members.

R. S. Ryder introduced the speaker of the evening, J. M. Hartman, engineer, Kewanee Boiler Corp., Kewanee, Ill. Mr. Hartman traced the evolution of the boiler, advising that steam was first developed in 150 B.C. and that a water heater had been found in Pompeii dating back to as early as 19 A.D. He stated that the Scotch marine boiler was the forerunner of the modern boiler, but vertical tubes were used at first causing quite a bit of leaking.

Mr. Hartman brought out that for years there was no standard for boiler ratings but that a capacity of 14 sq ft of radiation was obtained from 1 sq ft of heating surface. Mechanically-fired boilers improved this to 17 sq ft. He also mentioned that the sizes of residential and commercial boilers have been standardized throughout the industry and that the *ASME* Code for safety standards was inaugurated in 1914.

Mr. Hartman concluded his talk stressing the importance of always leaving clear water in a system as foam and dirt cause trouble in small orifices. Attendance 45.

• *VIRGINIA*—February 20, 1952. The highlight of the evening was an address by G. J. Murphy, of the engineering firm, Parsons, Brinckerhoff, Hall and MacDonald, New York, N.Y., designers of the tunnel being built between Berkley and Portsmouth, Va. Mr. Murphy was a resident engineer during the construction; and he discussed the ventilation of this vital traffic artery. The tunnel is made up of seven sections each approximately 30 ft in diameter and 300 ft long. The ventilation is accomplished by four large double-width, double-inlet fans each capable of exhausting 189,000 cfm against 6.1 in. water pressure. The fans are driven by adjustable speed drives capable of handling 237 brake horsepower at high speed. The fans are controlled automatically by carbon monoxide detecting elements within the tunnel. All fresh air enters at the two portals; the spaces below the road surface and the ceiling serve as exhaust plenums. During the discussion which followed the talk, several interesting points were brought out by Mr. Murphy with regard to the physical construction of the tunnel.

A letter from N. L. Rawlings, general manager of the Newport News Shipbuilding and Dry Dock Co., was read, inviting members to be their guests for an inspection tour of the new liner, S.S. United States, on April 13.

The meeting was called to order by Vice Pres. E. D. Duval at 8:15 p.m. in the auditorium of R. F. Trant Co. Attendance 12.

• *VIRGINIA*—January 16, 1952. Pres. J. F. Boyenton called the meeting to order in the auditorium of the R. F. Trant Co. building. The minutes of the November meeting and the January board of governors meeting were read and approved. F. R. Ervin, chairman of the auditing committee, reported that the treasurer's report had been examined and approved. President Boyenton advised that neither he nor D. E. Phillips could serve on the Chapters Conference Committee, and M. I. Taylor and F. R. Ervin were elected member and alternate member, respectively, to replace them.

The following officers for 1952 were unanimously elected as follows: *president*—D. E. Phillips; *vice president*—E. D. Duval; *secretary-treasurer*—H. E. Marquart; *board of governors*—J. F. Reynolds and T. B. Speights. Mr. Duval assumed the president's office in the absence of Mr. Phillips, and Mr. Marquart took over the duties of the secretary-treasurer. Mr. Ervin presented the past president's pin to Mr. Boyenton, retiring president, who thanked the Chapter for the cooperation he received in the discharge of his duties as president.

The following new members were accepted into the Chapter: W. H. Southerland, Jr., R. H. Francis, Jr., W. O. Michie, G. R. Anders, Sr., and I. K. Cassel. Attendance 21. Attendance ratio 0.53.

• *WESTERN MICHIGAN*—March 10, 1952. Members and guests met for dinner at St. Marks Church in Grand Rapids. Pres. W. C. DeRoo called the business meeting to order with the introduction of new members and guests. The minutes of the February meeting and the treasurer's report were read and approved. Announcement was made of the forthcoming Society Semi-Annual Meet-

ing, Spring Lake, N.J., June 16-18, and the 7th Oregon State Air Conditioning Conference to be held on the campus of Oregon State College, Corvallis, April 10-12.

Vice Pres. H. R. Limbacher introduced C. M. Humphreys, senior engineer, ASHVE Research Laboratory, Cleveland, Ohio, who spoke on *Weather Data for the Heating and Air Conditioning Engineer.*

Mr. Humphreys also showed slides of the new Environment Laboratory, explaining its construction and equipment. Attendance 57. Attendance ratio 0.44.

• *WESTERN NEW YORK*—March 10, 1952. Pres. T. F. Killeen called the meeting to order in the University Club, Buffalo, and the minutes of the February meeting were read and approved. C. W. Stone, chairman of the membership committee, presented a report on the new membership drive; and a letter of invitation to attend the Open House at the New York State University Technical Institute on April 4, was read. A memorandum from A. V. Hutchinson, executive secretary, was read, announcing the Semi-Annual Meeting at Spring Lake, N.J., June 16-18, and also announcing that the candidates for membership were being listed geographically in the JOURNAL, beginning with the March issue. The invitation from the Oregon Chapter to attend the 7th Oregon State Air Conditioning Conference at Oregon State College, Corvallis, was also read.

A film, entitled *Building the United Nations Secretariat Building*, was then shown through the courtesy of the United States Steel Corp. Attendance 58.

STUDENT BRANCHES

• *OKLAHOMA A & M COLLEGE*—March 7, 1952. Pres. S. N. Cohen called the meeting to order at 7:45 p.m. in the Engineering Building.

All Student Branch business was dispensed with and the meeting was immediately turned over to A. H. Scott, sales engineer, Johnson Service Co., Oklahoma City, Oklahoma. Mr. Scott gave a very comprehensive address on automatic temperature and humidity control systems. The address was supplemented by slides and a question and answer period followed. Attendance 8.

• *OKLAHOMA A & M COLLEGE*—February 7, 1952. The meeting was called to order in the College's Engineering Building, and the minutes of the previous meeting were read and approved.

S. N. Cohen and J. H. Churchwell reported having devised a way in which a compressor could be altered so as to show the working components functioning as the unit runs. It was added that the compressor, together with the necessary appurtenances, would be shown at the annual Engineering Open House, with the approval of Professors Venn and Irwin.

The following officers were elected to serve for the term: *president*—S. N. Cohen; *vice president*—J. H. Churchwell; *secretary*—H. G. Rice; *treasurer*—V. O. Wagner, Jr.; *student council representative*—T. M. Carr; and *faculty advisor*—Prof. R. R. Irwin. Attendance 8.

• *UNIVERSITY OF DETROIT*—January 23, 1952. The meeting was called to order by Pres. G. H. Williams at 8:15 p.m. in the Engineering Building.

A film entitled *Exhaust Hoods—Their Design and Application*, was shown through the courtesy of the University of Michigan Audio-Visual Education center in collaboration with the Michigan Department of Health and The American Air Filter Co. The film proved very interesting and educational and gave the students an idea for a display at the University's annual engineering show.

Catalogs and trade bulletins, contributed by the Michigan Chapter under a cooperative program initiated by G. W. Akers, president of the Chapter, and J. B. Olivieri, student branch committee chairman, were then distributed. President Williams advised that a letter of appreciation had been sent to the Chapter.

J. E. Lay, faculty advisor, suggested that the ASHVE and *ASME* Student Branches hold joint meetings, and a committee was named to work with *ASME* in acquiring a speaker. Attendance 17.

John R. Allen Memorial Library

The ASHVE Committee on Research gratefully acknowledges the following gifts to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Fuel Oil Manual, by Paul F. Schmidt, New York. Gift of *The Industrial Press*, 1951 (Clifford Strock).

Fluid Flow in Pipes, by Clifford McClain, New York. Gift of *The Industrial Press*, 1952 (Clifford Strock).

Industrial Heat Transfer, by F. W. Hutchinson, 1st Edition, New York. Gift of *The Industrial Press*, 1952 (Clifford Strock).

Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources, Vol. III: *Fuel and Energy Resources*, New York. Gift of the United Nations Department of Economic Affairs, 1951.

Odors and the Sense of Smell (a bibliography), New York. Gift of Airkem, Inc., 1952.

The presentation of textbooks and pamphlets in the field of heating, ventilating, and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 82 applications for membership, including 5 student applications and 3 reinstatements; in addition 6 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by May 30, 1952, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Arkansas

WILKINS, W. E., Pres., Independent Engineering Corp., Little Rock. REFERENCES: S. W. Beaty, R. E. Blaylock, W. S. Hyde, H. M. Keller.

California

DUNCAN, S. F., Director of Research, Farr Co., Los Angeles. REFERENCES: V. J. Burke, E. C. Evans, R. S. Farr, I. F. Norcross.

MERKEL, H. F., Asst. Chief Engr., Royal Heaters, Inc., Alhambra. REFERENCES: A. J. Hess, H. McLaughlin*, R. A. Moore, Jr.*, Arthur Tudury*.

SLEIGHT, G. F., Jr., Indus. Engr., Trade-Wind Motorfans, Inc., Los Angeles. REFERENCES: R. H. Clark, L. B. Davenport, V. W. Sharpe, Lee Updegraff.

Colorado

KLEIN, M. D., Secy.-Treas., Mechanical Equipment Co., Denver. REFERENCES: N. H. Brickham, H. H. Herman, J. J. Johnson, H. W. Marshall.

ROSEN, S. W., Pres., Mechanical Equipment Co., Denver. REFERENCES: N. H. Brickham, H. H. Herman, J. J. Johnson, H. W. Marshall.

Connecticut

OSTBERG, J. O., Treas. & Engr., E. R. Clement, Inc., Bridgeport. REFERENCES: T. L. Arnold, H. J. Blakeley, P. D. Harrigan, D. M. Hummel.

District of Columbia

MILLER, W. G., Mgr., Radiant Heating Div., Miller Building Supply Co., Inc. Washington. REFERENCES: Philip Brotman*, A. E. Crawford, Samuel Kalb*, Bernard Shields.

STEPHENS, C. S., Cons. Engr., Washington. REFERENCES: A. E. DeSomma*, L. F. Howe*, G. F. Landgraf, N. P. Stathis*.

THOMPSON, L. C., Mech. Engr., Bureau of Ships, U.S. Navy Dept., Washington. REFERENCES: C. C. Carson, A. E. DeSomma*, R. M. Marraxzo, C. J. Thompson.

Georgia

AMMONS, H. A., Engr., Ketterson, Lazenby & Borum, Atlanta. REFERENCES: J. W. Borum, F. W. Bull, R. B. Kitch, J. M. Lazenby.

Illinois

ACIERNO, T. G., Design Draftsman, Corn Products Refining Corp., Chicago. REFERENCES: M. W. Bishop, W. S. Bodinus, H. G. Gragg, Henry Lauterbach.

GRAMIN, WILLIAM, Buyer, Heating Dept., Montgomery Ward, Chicago. REFERENCES: A. N. Nelson, W. R. Teller, A. L. Walters, F. J. Wilkinson.

WEILER, J. J., Project Engr., Minneapolis-Honeywell Regulator Co., Chicago. REFERENCES: J. R. Carroll, Jr., J. F. Cummiskey, H. C. Gotschall, A. P. Kratz.

Indiana

†BECKER, R. K., Vice Pres., Ohio Valley Hardware & Roofing Co., Evansville. REFERENCES: S. Konzo, F. L. Meyer, H. F. Randolph, R. W. Roose.

Louisiana

CRETTET, M. E., Chief Engr., Air Installation Div., U.S. Air Force, Barksdale. REFERENCES: J. W. Cherry, W. J. Drawe, W. E. Fitzgerald, R. L. Patton.

Maryland

△HEWITT, F. M., Partner, Taze and Hewitt, Baltimore. REFERENCES: E. L. Crosby, W. P. Flanigan, G. B. Priester, E. H. Taze.

KANE, B. R., Project Mgr., Lloyd E. Mitchell, Inc., Baltimore. REFERENCES: J. H. Baker, H. D. Glaser, R. W. Pentecost, R. F. Weisman.

Massachusetts

PARKER, W. J., Jr., Engr., Barnes & Jones, Inc., Boston. REFERENCES: W. E. Barnes, J. A. Bonner, C. W. Larson, N. J. H. Shaw.

Michigan

STRAND, D. C., Supt., Bruce Wigle Co., Detroit. REFERENCES: C. A. Strand, R. E. Strand, K. J. Wagoner, K. G. Wigle.

TILIACOS, A. N., Graduate Student, University of Michigan, Ann Arbor. REFERENCES: F. N. Calhoon, A. B. Epple, H. E. Keeler, Axel Marin.

Minnesota

ARNDT, W. F., Mfrs. Agent, Duluth. REFERENCES: C. W. Beatty*, C. E. Foster, J. M. Kane, Ernie Orrick*.

GENG, D. F., Mech. Engr., Ellerbe & Co., St. Paul. REFERENCES: J. V. Borry, R. C. Bosworth, J. F. Pfost, William Sturm.

GISH, R. W., Design Engr., Ralph D. Thomas and Assocs., Inc., Minneapolis. REFERENCES: H. R. Nichols, M. E. Quigley, E. J. Uhl, W. E. Ward.

JACK, R. M., Engr., Uhl Co., Minneapolis. REFERENCES: A. B. Algren, G. M. Orr, E. J. Uhl, W. F. Uhl.

JACOBS, H. E., Engr., Charles Foster, Cons. Engr., Duluth. REFERENCES: P. H. Anderson, R. T. Dean, Charles Foster, A. I. Sher.

JOHNSON, R. L., Dist. Repr., Minneapolis-Honeywell Regulator Co., Duluth. REFERENCES: J. E. Haines, B. F. McLouth, E. F. Snyder, Jr., C. E. Wiser.

LINDSTROM, H. C., Branch Mgr., General Controls Co., Minneapolis. REFERENCES: H. E. Gerrish, H. H. Herman, W. H. Ray*, F. B. Rowley.

PLAUNT, J. A., Vice Pres., Broman-Plaunt Co., Duluth. REFERENCES: Robert Fitzgerald*, Charles Foster, L. A. Mathies, E. F. Orrick*.

TURNHAM, T. R., Engr., Uhl Co., Minneapolis. REFERENCES: A. B. Algren, G. M. Orr, E. J. Uhl, W. F. Uhl.

Missouri

DOUBLEDAY, C. E., Mgr., Doubleday Heating Co., Kansas City. REFERENCES: H. A. Atwater, John Douglass, C. D. Jones, W. A. Reichow.

Missouri (*continued*)

DOUBLEDAY, F. E., III, Mgr., Furnace Supply Co., Inc., Kansas City. REFERENCES: H. A. Atwater, John Douglass, C. D. Jones, W. A. Reichow.

†HORCH, G. E., Cons. Engr., St. Louis. REFERENCES: E. E. Carlson, E. T. Clucas, J. W. Cooper, G. W. F. Myers.

KERR, W. N., Proprietor, Whitney M. Kerr Co., Kansas City. REFERENCES: D. M. Allen, J. R. DeRigne, W. K. Dyer, C. L. McMichael.

New Jersey

BRANCS, H. A., Sales Repr., L. J. Wing Mfg. Co., Newark. REFERENCES: H. M. Patrick, T. R. Peyrek, C. H. Smith, H. S. Wheeler.

New York

BROWN, K. A., Htg., Vent., Air Cond. Engr., Voorhees, Walker, Foley & Smith, New York. REFERENCES: J. B. Dietze, J. J. Kopecky, S. W. Ross*, H. N. Seelinger.

DESSUREAU, E. A., Jr., Field Supv., Gulf Oil Corp., New York. REFERENCES: H. W. Bruyn*, W. M. Gilbreth*, W. G. Kane, A. G. Purdue*.

△FERRARINI, JOSEPH, Vice Pres., Conversions & Surveys, Inc., New York. REFERENCES: G. C. Beck*, E. F. Kennedy*, T. C. Moran*, T. L. Robey*.

FOX, E. B., Jr., Engr., St. John & Platt, Cons. Engrs., Binghamton. REFERENCES: C. J. Doughty, L. H. MacAlmon, E. C. Shepard, J. W. Stevens.

GEZARI, ZVI, Plant Mgr., Charles F. Guyon, Inc., New York. REFERENCES: W. R. Bryans*, M. C. Giannini, P. B. Gordon, C. E. Gus*.

JULIANI, A. M., Engr., Minneapolis-Honeywell Regulator Co., New York. REFERENCES: L. F. Glagg, Ernst Graber, C. S. Koehler, O. F. Quist, Jr.

LINDSAY, D. C., Vice Pres. & Dir., Air & Refrigeration Corp., New York. REFERENCES: W. L. Fleisher, E. W. Gifford, J. E. Haines, Herman Worsham.

MUSCHETT, W. R., Designer, N. Y. Central System, New York. REFERENCES: J. J. Fetscher, M. C. Giannini, B. J. Steinke, J. F. Steinke*.

SOLOMON, S. J., Asst. Engr., Abraham Abrams, Cons. Engr., New Rochelle. REFERENCES: Abraham Abrams, H. Bensen*, C. S. Koehler, Manfred Moses.

ZIMMERMAN, MAX, Project Engr., Raisler Corp., New York. REFERENCES: L. K. Berman, Harold Herkimer, R. K. Raisler, F. F. Taverna.

Ohio

DUSENBURY, L. S., Engr., Powers Regulator Co., Cleveland. REFERENCES: Arnold Kincaid, T. E. Murphy, R. Raymond*, D. S. Ross.

ERNST, K. R., Sales Repr., Merco Inc., Cincinnati. REFERENCES: Weston DeGrass*, R. A. Harris*, E. F. Sullivan*, J. J. Tighe*.

KESSEN, C. F., Htg. Engr., The Mutual Mfg. & Supply Co., Cincinnati. REFERENCES: R. C. Beineke, E. J. Kramer, J. F. Leisgang, Pinkney Varble.

MCCARTHY, A. J., Engr., Johnson Service Co., Columbus. REFERENCES: R. M. Rose*, P. D. Shepperd, J. W. Sterling, Jr., R. D. Wilson*.

SCHERMER, RICHARD, Mgr., Bldg. Equip. Sales, Duriron Co., Dayton. REFERENCES: Howard Bayer*, G. S. Goodwin*, R. M. McFarland*, M. W. Smith*.

Oklahoma

RITTER, W. T., Jr., Sales Trainee, The Trane Co., Oklahoma City. REFERENCES: H. D. Bareither, J. R. Fellows, E. M. Jameson, A. C. Menke.

Pennsylvania

JOHNSTON, J. M., Industrial Engr., United Engineers & Constructors, Inc., Philadelphia. REFERENCES: R. F. Hunger, Frank Pfeiffer, G. W. Powell, Jr., Pierce Timmis.

MOUNT, H. V., Jr., Engr., H. H. Robertson Co., Philadelphia. REFERENCES: H. R. Keperling, M. G. Kershaw, G. E. Klapper, W. W. Malloy.

WILLIAMS, K. A., Engr., William H. Walters & Sons, Philadelphia. REFERENCES: M. E. Blankin, C. F. Dietz, C. J. Lubking, E. K. Wagner.

Tennessee

GREEN, J. R., Engr., Minneapolis-Honeywell Regulator Co., Memphis. REFERENCES: A. T. Bevil, G. C. Burr, J. P. Manis, H. A. Simpson.

MENGEL, J. P., Pres., General Mgr., Chickasaw Heating & Engrg. Co., Inc., Memphis. REFERENCES: H. E. Culley*, N. M. Landaiche*, R. T. Lowrie*, F. B. Morse.

△REILEY, T. D., Mgr., Johnson Service Co., Nashville. REFERENCES: J. J. Bechtol, E. C. Horn, E. W. McNamee, K. A. Wright.

THWEATT, W. E., Field Engr., H. A. Simpson Engrg. Service, Memphis. REFERENCES: T. O. S. Humphrey, Jr., R. W. Johnson, A. W. Lenz, H. A. Simpson.

Texas

BRIGHT, J. S., Owner, Comfort Control Co., San Angelo. REFERENCES: Charles Crawford*, K. A. Eschmann, Jr., D. R. Goss*, Sidney Pines.

FREER, A. L., Engr.-Estimator, Beals Plumbing & Heating Inc., Fort Worth. REFERENCES: D. E. Beals, F. S. McLaren, B. R. Miller, J. L. Tye.

△SPRANLEY, M. S., Territory Mgr., Lennox Furnace Co., Fort Worth. REFERENCES: J. S. Burke, L. V. Busenlener, Ralph Elizardi, R. B. Guest.

△VEITH, G. S., Sales Mgr., Lennox Furnace Co., Fort Worth. REFERENCES: J. S. Burke, Ralph Elizardi, R. B. Guest, M. S. Spranley.

WORSHAM, W. A., Jr., Engrg. Draftsman. Zumwalt & Vinther, Cons., Engrs., Dallas. REFERENCES: F. L. McFadden, Jr., J. F. Roberts, P. N. Vinther, Ross Zumwalt.

Utah

△ASHTON, J. L., Pres., Ashton Heating and Air Conditioning Co., Salt Lake City. REFERENCES: A. R. Curtis, C. E. Ferguson, E. V. Gritton, E. J. Watts.

Virginia

BURKS, S. E., Repr., P. L. Guest, Richmond. REFERENCES: J. F. Boyenton, J. F. Reynolds, W. R. Robinson, Laurence Trant.

DELINGER, D. C., District Repr., Minneapolis-Honeywell Regulator Co., Norfolk. REFERENCES: L. B. Belford, F. R. Benson*, J. F. Boyenton, J. E. Haines.

Washington

ARNOLD, A. A., Engr., United States Radiator Corp., Seattle. REFERENCES: E. O. Eastwood, E. H. Gibson, Jr., R. H. Lunger*, W. J. Olson.

ASHLEY, W. H., Jr., Htg. Engr., Marshall-Wells Co., Spokane. REFERENCES: H. A. Bickel, J. A. Doyle, R. L. Nelson, Jr.*, K. M. Wood.

△DOMINY, C. B., Mech. Engr., Puget Sound Naval Shipyard, Bremerton. REFERENCES: D. L. Clark, Leo Classen, H. O. DeBolt, M. C. McLennan.

FELDSTED, R. J. C., Engr., Western Blower Co., Seattle. REFERENCES: L. F. Christoferson, K. G. Massart, W. T. Scott, R. M. Stern.

Wisconsin

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OBITUARIES

FREDERICK E. W. BEEBE
New York, N.Y.

Frederick E. W. Beebe, former sales engineer with Johnson Service Co., died on March 3, 1952, at his home in Elizabeth, N. J.

Mr. Beebe was born in Elizabeth on March 6, 1878, and he attended schools there. He was with the New York office of Johnson Service Co. for his entire career, a period of approximately 50 years. Beginning as an office boy, he received drafting and shop experience, and eventually worked himself up to sales engineer, from which position he retired in 1942.

The half-century which covered his intimate connection with the heating and ventilating industry extended practically all the way from stove heat to modern air conditioning. Mr. Beebe was a gentle, lovable man and a good sales engineer; and his associates feel that his death marks the passing of a sort of tradition in the industry in which he spent his life.

Mr. Beebe joined the Society in 1915, and he was elected to Life Membership in 1943. He was an active New York Chapter member, having served as its treasurer from 1922 to 1931. He was also a Life Member of the New York Chapter.

The Society's Officers and Council extend their sincere sympathy to his widow, Mrs. Ottilie Reuther Beebe, and to his family.

CHARLES W. HALLENBECK
Charlotte, N.C.

Charles W. Hallenbeck, Society member since 1944, passed away in January, 1952, in Charlotte.

Born on March 22, 1897, at Leon, N. Y., Mr. Hallenbeck attended the State Normal High School at Fredonia, N. Y., from 1911 to 1915, and Rensselaer Polytechnic Institute, Troy, N. Y., and Georgia School of Technology, Atlanta, Ga., from which he received a B.S. in mechanical engineering in 1924.

Mr. Hallenbeck's first position was with the Moncrief Furnace Co., Charlotte, from 1924 to 1931, during which time he served as sales engineer, assistant manager and branch manager of the company's Carolinas Branch office. From 1931 to 1937, Mr. Hallenbeck was proprietor of Air Conditioning Co.; and he was sales engineer and assistant sales manager in domestic and commercial forced air heating, ventilating and comfort air conditioning from 1937 to 1941 with Page-Williamson, Inc. In 1940 the company's name was changed to Page and Co.

Mr. Hallenbeck joined T. C. Heyward, manufacturing representatives for Carrier Corp., as district engineer in 1941 and served in that capacity until the time of his death.

JOSEPH C. HARTWELL
Providence, R.I.

The Society announces with regret the passing of one of its honored group of Life Members, Joseph C. Hartwell, president of Hartwell Co., Inc., Providence, R. I., on January 19.

Mr. Hartwell, born in Providence in 1874, attended public and private schools, Worcester Academy, and Brown University. His first experience was in steamfitting. After a year at this, he became a draftsman on heating, power, and piping jobs, which he continued for ten years. From 1910 to 1921 he was an engineer and contracting agent, and in 1921 he joined Grinnell Co., Inc., where he served as department manager, and later Eastern district manager, Heating, Power, and Industrial Piping Division. He remained with Grinnell until 1934 when he formed his own company, Hartwell Co., Inc.

Mr. Hartwell joined the ASHVE in 1922, and was elected to Life Membership by the Council in 1944.

WALTER R. ILLIG
Fitchburg, Mass.

The Society has been notified of the death of Walter R. Illig, on January 15. He had been a Society member for a period of approximately 25 years.

Mr. Illig, born on February 2, 1892, at Providence, R. I., took heating and ventilating courses at Lowell Institute and Franklin Institute. In 1919, after completing his apprenticeship, Mr. Illig joined the Central Supply Co., Worcester, Mass., in the Sales Engineering Department. From 1925-26 he was employed by the Fitchburg Plumbing Supply Co., Fitchburg, Mass., as branch manager, and from 1926 to 1935, he served as manager of the Plumbing and Low Pressure Heating Department for the Jennison Co., Fitchburg. Mr. Illig started his own business in 1935, and he operated it until the time of his death.

WILL M. SAWDON
Ithaca, N.Y.

Professor Emeritus Will M. Sawdon, Ithaca, N. Y., teacher of engineering at Cornell University for 41 years and mayor of Ithaca for two years, died at his home on April 1, 1952, at the age of 79.

Professor Sawdon was born in Aurora, Ind., in 1873. He received his B.S. degree in mechanical engineering at Purdue University in 1898, and his master's degree in mechanical engineering at Cornell in 1908.

Before coming to Cornell in 1904 as instructor in experimental engineering, he taught at the Detroit School for Boys, Kansas State College, and Armour Institute of Technology, Chicago, Ill. He was advanced to assistant professor of experimental engineering at Cornell in 1908, and to professor in 1919. For many years he was secretary of the Engineering Experiment Station, and in 1941 was made acting head. He also taught heating and ventilating engineering, refrigeration and mechanical laboratory, and was responsible for the leather belting laboratory when this was the only one of its kind in the country. He did wide testing of steam engines, radiators and pumps, and published many papers on radiators, heating and ventilating, which were published in the Society's JOURNAL and TRANSACTIONS.

He first retired from the University in June 1941, but was recalled in the Fall of that year to teach mechanical laboratory courses for the Navy's V-12 program. He was again retired in August 1945.

Professor Sawdon, active in civic affairs, first held public office as a member of the municipal civil service commission. He was elected Mayor of Ithaca in November 1923 and served a two-year term. At the time Professor Sawdon's candidacy for the mayoralty was announced, Mayor Louis P. Smith, whom he succeeded, said: "It would be difficult to find a citizen of Ithaca more interested in its welfare than Will Sawdon. I know his great capability, his earnestness and thoroughness and above all his great love for the city which has been his home for 20 years."

Professor Sawdon served as a member of the Board of Public Works for 17 years, serving three terms. Professor Sawdon served as inspector in the U.S. Fuel Administration during World War I.

An active Mason for many years, he was a member of the original board and president of the Masonic Temple Corporation at the time the temple was built on N. Cayuga St., Ithaca, and was past high priest of Eagle Chapter 58, Royal Arch Masons; past commander of St. Augustine Commandry 38, Knights Templar, and prelate through 1950.

He was a long-time member of the Ithaca Rotary Club, a member of the Ithaca Protective Police, a director of Treman, King & Co., and for many years was active in the *Tompkins County Tuberculosis and Public Health Association*. Professor Sawdon, a Life Member of ASHVE, also held membership in the *ASME*, the *American Society of Engineering Education*, Sigma Xi, Gamma Alpha, Atmos, and Order of DeMolay.

He is survived by his widow, Mrs. Adelaide Wilder Sawdon; two sons, George W. Sawdon of Garden City, L.I., and W. W. Sawdon of Palo Alto, Calif; three daughters, Mrs. Walter C. Guthrie of Pavilion; Mrs. Warren Taylor of Plattsburg, N.Y., and Miss Agnes Sawdon of Ithaca, to whom the Officers and Council extend their sincerest sympathy.

KENNETH H. BEAUDOIN
Chicago, Ill.

Kenneth H. Beaudoin, U. S. Navy, was taken ill suddenly on February 10, 1952, and died the same day of spinal meningitis aboard the U.S.S. Helena. Mr. Beaudoin had been on leave for a month during the Christmas holidays, following eight months of service with the Navy in Korea. He had entered the service in October of 1950.

Mr. Beaudoin was born on May 3, 1924 in Chicago, Ill. He attended Wilson Junior College, from February 1946 to June 1947, and Michigan College of Mining and Technology, from June 1947 to June 1949, graduating with a B.S. in mechanical engineering. Mr. Beaudoin was also a student member of the *American Society of Mechanical Engineers*.

The Officers and Council of the Society extend their sincere sympathy to Mr. Beaudoin's widow.

HARLEY H. SMITH
Washington, D.C.

Harley H. Smith, manager of the Washington, D. C., Branch of the United States Radiator Corp., died on March 4, 1952.

Mr. Smith was born on March 17, 1895 in Marion, Ohio, and attended Southwestern High School and Wayne University in Detroit. He was associated with the U. S. Radiator Corp. for a period of 35 years, beginning in the company's Heating, Radiator and Boiler Foundry Department. He was then assigned to sales promotion in 11 southern states and all the territory west of the Mississippi River. Later he was appointed as assistant to the general sales manager. During World War II, he was in charge of the corporation's Government Office in Washington, D. C. Mr. Smith, whose home was at 1523 Ethel, Lincoln Park, Mich., had been in charge of the Washington, D. C. Branch since 1947.

The Officers and Council of the Society offer their sincere sympathy to his widow and family.

ROBERT F. WORMLEY
Toronto, Ont., Canada

Robert F. Wormley passed away suddenly on March 27, 1952 in Toronto.

Born in Kalamazoo, Mich., on August 22, 1902, Mr. Wormley attended Parkdale Collegiate for six years.

Mr. Wormley joined the Grinnell Company of Canada, Ltd., in 1921, starting with general office work until 1928 when he was made sales engineer attached to the Toronto office. He remained in that position until 1935 when he was made manager of the company's Montreal Branch. At the time of his death, Mr. Wormley was manager of the company's Engineered Products Division, located in the Toronto office.

The Society's Officers and Council extend their sincere sympathy to Mr. Wormley's family.

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OFFICERS OF LOCAL CHAPTERS AND STUDENT BRANCHES

(49 Chapters—11 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, E. N. Pettit, Jr., 904 Wallace Bldg. SECRETARY, R. E. Blaylock, 509 E. Markham St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, F. A. Player, 2110 Peachtree Rd., N. W. SECRETARY, J. M. Lazenby, 2641 Merry Lane, N. E., (6).

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, W. P. Flanigan, 5508 Greenleaf Rd. (10). SECRETARY, F. M. Hewitt, 11 E. 21st St. (18).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, M. E. Minaker, 1128 Burrard St. SECRETARY, D. W. Thomson, 445 Richards St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, J. H. Carpenter, 3515 Midland Ave. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, R. S. Curl, 590 Oak St. SECRETARY, N. T. Hess, 63 E. Goodale St.

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, J. J. Bechtol, P.O. Box 1667, (1). SECRETARY, R. C. Beineke, 626 Broadway (2).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, A. J. Lawless, 110 Whitney Ave. SECRETARY, R. W. Sidbury, 236 Grand St., Waterbury (91).

● **DELTA.** 1939. Hdqrs., New Orleans, La. Meets, Second Tuesday. PRESIDENT, Theodore Offner, 1000 S. Peters St. SECRETARY, H. L. Salaun, 517 Baronne St.

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, D. A. Carofano, 1821 Highland Ave., Troy. SECRETARY, G. G. Davis, 323 State St., Schenectady.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. Janes, University of California, Dept. of Grounds & Bldgs., Berkeley (4). SECRETARY, J. E. Murray, 1095 Market St. (3).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, G. W. Bornquist, 605 W. Washington Blvd. (6). SECRETARY, G. V. Zintel, 1217 W. Washington Blvd. (7).

● **INDIANA:** 1945. Hdqrs., Indianapolis, Ind. Meets, Fourth Friday. PRESIDENT, F. C. Barton, 912 K. of P. Bldg. SECRETARY, R. C. Blackman, 3505 N. Illinois St. (8).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, L. E. Marque, 3803 N. Atlantic. SECRETARY, R. J. Harris, 116 N. Division St., (8).

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, C. H. McGuiness, 712 Park St. SECRETARY, J. F. Sandfort, M.E. Dept., Iowa State College, Ames.

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. PRESIDENT, R. F. Bauer, 434 N. Rock Island. SECRETARY, E. G. Fahnestock, P.O. Box 2581, Hillside Station.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, C. W. Schumacher, 1920-22 Grand Ave. SECRETARY, G. H. Stoffer, 200 Riss Bldg., 15 West 10th St. (6).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, J. F. Bertram, 550 Notre Dame Ave. SECRETARY, A. K. Piercy, 222 Osborne St., N.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, John Bonner, 92 Broadway, Cambridge (42). SECRETARY, L. R. Geissenhainer, 89 Broad St. (10).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, R. E. Larkin, 515 W. Clover Dr. SECRETARY, A. T. Bevil, 212 Robinson Bldg., 160 Union (3).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Bergman, Box 95, Riverdale Sta. (5). SECRETARY, D. E. Tullis, 1720 Park Pl. (6).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, G. W. Akers, Box 238, R.F.D. 2, Rochester. SECRETARY, R. H. Oberschulte, 316 McKerchey Bldg. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, E. F. Snyder, Jr., 4324 Zenith Ave. N (22). SECRETARY, J. A. Holbrook, 65 North 17th St. (3).

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, J. G. Chenevert, 1440 St. Catherine St. W. SECRETARY, B. J. Horsburgh, 637 Craig W., Rm. 212.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, K. E. Martin, 204 Barker Bldg. (2). SECRETARY, O. J. Smith, 233 Grain Exchange Bldg. (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, Ernst Graber, 215 Hollywood Ave., Douglaston, L. I. SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, R. E. Allison, 607-11 First Ave. (10). SECRETARY, M. W. Brown, 1213 Texas Bank Bldg. (2).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. PRESIDENT, C. H. Dollmeyer, Jr., 1533 N. New Haven Ave. (15). SECRETARY, V. W. Miles, 624 So. Boston Ave., Box 871.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, John Richmond, 10210 Woodland Ave. (4). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs. Greensboro, N.C. PRESIDENT, L. L. Vaughan, P.O. Box 5746, Raleigh. SECRETARY, J. W. Bunn, Jr., 2705 Lochmore Dr., Raleigh.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, J. H. Carnahan, 320 Oklahoma Natural Gas Bldg. (2). SECRETARY, W. J. Collins, Jr., 224 Oklahoma Natural Gas Bldg. (2).

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, William Philip, 5 Barbara-Crescent. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, H. W. McKenzie, 399 Murray Ave., Beaverton. SECRETARY, R. P. Lankow, 3408 S.E. Hawthorne Blvd. (15).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, R. M. Stern, 5121 E. 68th (5). SECRETARY, H. T. Orebaugh, 1330 Dearborn.

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, E. K. Wagner, 2240 N. Broad St. (32). SECRETARY, A. M. Robertson, 1200 Locust St. (7).

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, W. D. Simpson, 501 Standard Life Bldg. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, B. H. Spurlock, Jr., Dept. of M. E., University of Colorado, Boulder. SECRETARY, J. W. Braak, 1230 California St.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, L. L. Hamig, 1706 Olive St. (3). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, R. M. Hood, 411 Louisiana Ave. SECRETARY, M. A. Hudson, 4609 Gilbert Dr.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, R. J. Salinger, 910 Bankers Mtg. Bldg. (2). SECRETARY, E. G. Floeter, Jr., P.O. Box 6006 (6).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, M. C. Greiner, 1559 Club View Dr. (24). SECRETARY, L. B. Davenport, 137 S. Anderson St. (33).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs. Charlotte, N.C. PRESIDENT, R. M. Warren, Jr., P.O. Box 1755, Charlotte. SECRETARY, J. A. Rice, P.O. Box 1755, Charlotte.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, W. E. Long, Dept. of Mechanical Engrg., University of Texas, Austin. SECRETARY, L. H. Hornor, Jr., 810 Insurance Bldg.

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, First Wednesday. PRESIDENT, A. R. Curtis, 5158 Cottonwood Lane, Holladay. SECRETARY, M. L. Gollaher, 1165 Roosevelt Ave. (5).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, D. E. Phillips, P. O. Box 674, Newport News. SECRETARY, H. E. Marquart, 111 W. Main St. (10).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, S. R. Allen, 942 Washington Bldg. (5). SECRETARY, P. H. Loughran, Jr., 4513 49th St., N.W. (16).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, W. C. DeRoo, 500 E. 8th St., Holland. SECRETARY, P. D. Winchester, 322 Columbia Ave., Holland.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, T. F. Killeen, 374 Delaware Ave. (2). SECRETARY, R. E. Lang, 140 Meadow Lane, Kenmore (23).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, H. F. Brinen, 2226 Kinzie Ave., Racine. SECRETARY, L. C. Plaehn, 914 N. Broadway.

STUDENT BRANCHES

● **COLLEGE OF CITY OF NEW YORK:** 1949. Hdqrs., New York, N. Y.

● **LOUISIANA POLYTECHNIC INSTITUTE:** 1949. Hdqrs., Ruston, La. PRESIDENT, W. G. McMullen, Box 472, Tech Station. SECRETARY, R. L. Gorton, Box 184, Tech Station.

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3333, Bagwell Dormitory.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, Stuart Cohen, 513 ½ Knoblock. SECRETARY, H. G. Rice, 5 Chickasha, Box 417, Vets Village.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, D. W. Blair, 223 W. 15th St. SECRETARY, C. D. Cannon, 404 N. 26th St.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, G. H. Williams, 18251 Washburn (21). SECRETARY, R. H. Drake, 5598 Hurlbut (13).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts. SECRETARY, V. H. Miles, PHP Dorm J.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, J. A. Slemin, 21 Wilberton Rd. SECRETARY, T. O. Smith, 455 Avenue Rd.

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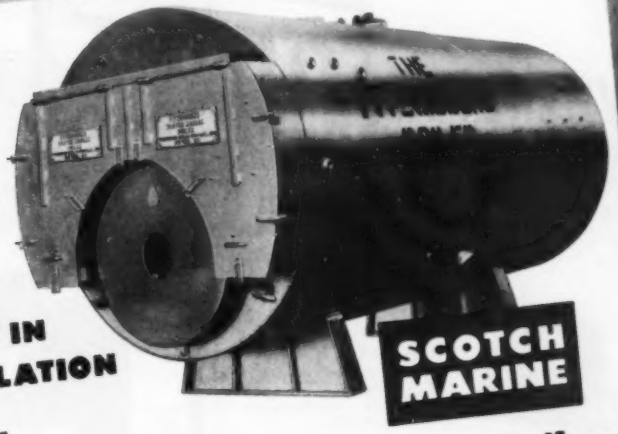

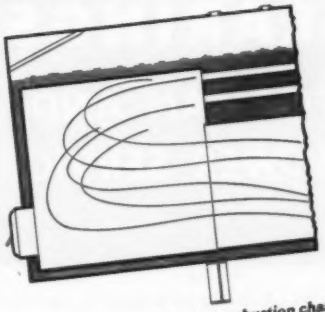

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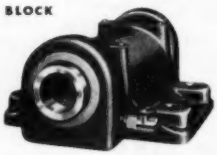

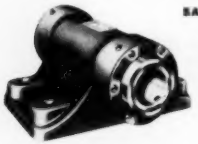

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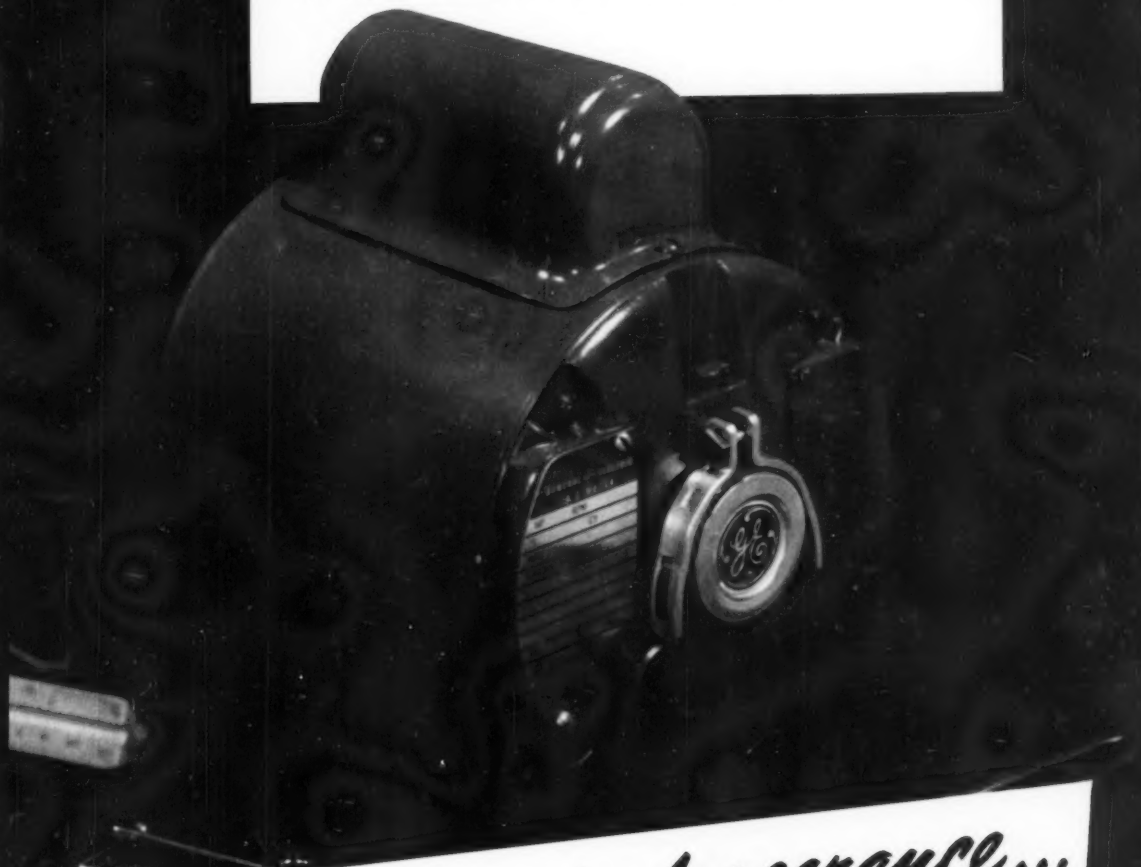

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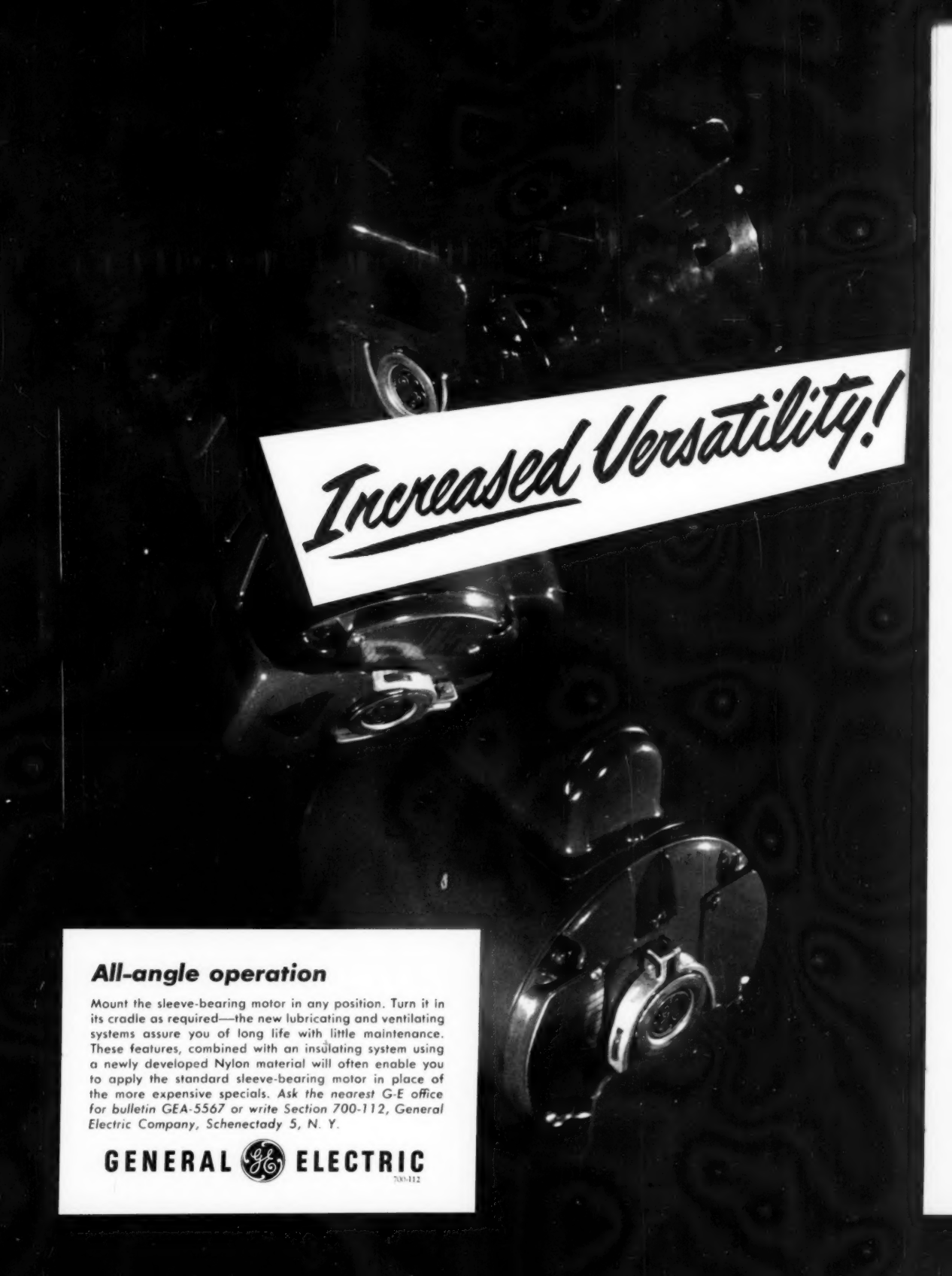

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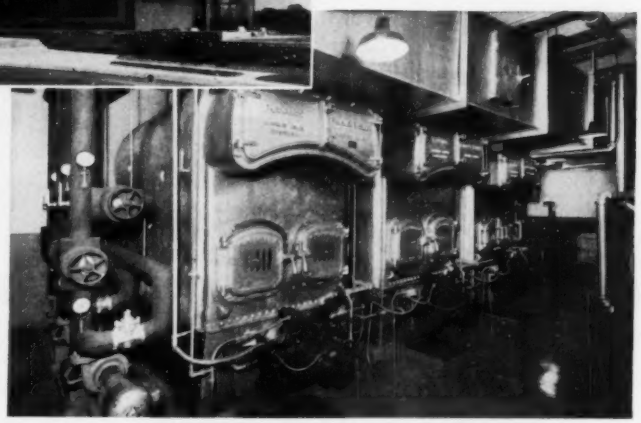

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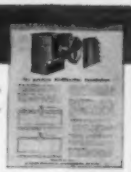

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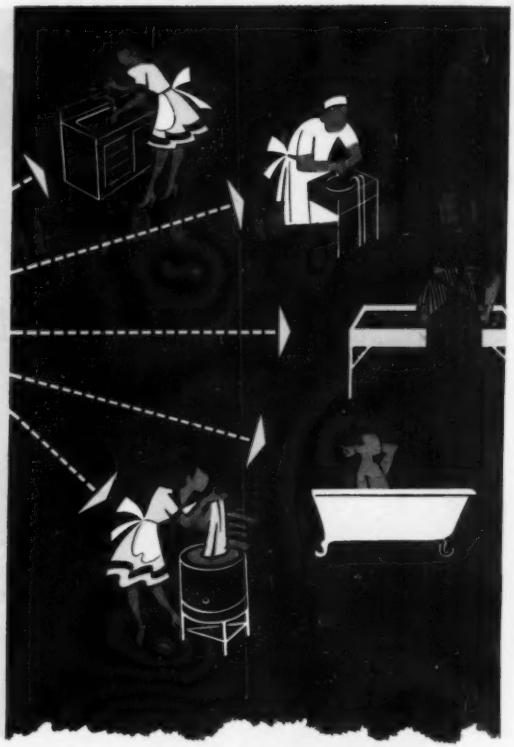
*City*_____ *State*_____

Sylphon Temperature Regulator No. 999
—fully modulating; automatic



Real help for hot water users!

● Having a continuous supply of uniform temperature hot water from storage is easy—when you have Sylphon Temperature Regulator No. 999 on the job. It's ideal for apartments, offices, hotels, institutions and industrial plants. Fully modulating, it maintains constant, "set" temperature. Operates automatically, eliminates manual control. Self-contained and self-powered, No. 999 requires no auxiliary power source. It does not cease to function in the event of line or compressor failures.

No. 999 has many features that assure years of reliable, economical performance. It has stainless steel frame for minimum heat conduction from valve to regulator head. Neat and compact, it has less height and weight than other types. Its 2-ply Sylphon bellows provides added power. The *No. 999-T* model has a dial indicating thermometer, for added convenience.

Besides its use with storage water heaters, No. 999 is also recommended for many industrial applications such as metal plating tanks . . . bottle washers . . . treaters . . . slashers, etc. Write for Catalog JH-A.

FIRST WITH BELLOWS

Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
DIVISION

ROBERTSHAW-FULTON CONTROLS CO. KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal

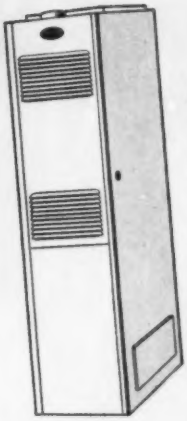
UTILITY

50 RD DUAL WALL HEATER

DUAL WALL HEATER

Your first winner in the profit stakes is Utility's 50 RD Recessed Dual Wall Heater. Why? Because it's been a sensational seller ever since it was introduced. And there are good reasons for this: It's low in price ...it gives living-level comfort, circulating warm air where your customers want it...and prospects love its cool-to-touch Fiberglas insulated panel. Fully automatic controls...fits between standard 16" center studs...50,000 BTU input, 35,000 BTU output...60" high, 17" wide, and 100% handsome! AGA approved.

70 FA FORCED AIR FURNACE



FORCED AIR FURNACE

The second hands-down winner is Utility's new 70 FA Forced Air Furnace. It's competitively priced, and it has all these easy-to-sell features: newly-engineered Sy-Lent* heat exchanger practically eliminates noise as furnace heats and cools...Dy-Rekt* drive blower assembly is the quietest yet...approved for zero clearance, and can be safely installed next to combustible material without outside insulation...easy to install, can be spotted in only 14"x 25½" floor space (in closets, alcoves, etc)! AGA approved.

UTILITY TRADE MARK — Engineered Heating Performance

MAKE MORE PROFITS YEAR-'ROUND WITH UTILITY HEATING AND COOLING EQUIPMENT
MAIL COUPON TODAY!

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Please send me information about how I can build bigger year-'round business with Utility Heating and Cooling Equipment.

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Ryan's

VOL. 12 NOV. 1, 1951 No. 7

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Ryan Aeronautical Company
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Frances L. Kohl, art and production editor
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D-17 flanges are precision turned on vertical turret lathe. This exhaust cone converts G-E J-47 turbojet into afterburner version with added kick.

ON THE COVER

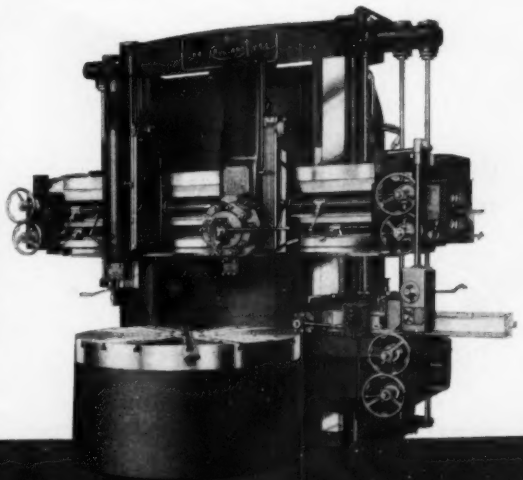
Our Sincere Thanks to those who have recognized our efforts to Produce a Machine Tool for Manufacturing to the Highest Standards.

In Bullard Machine ... orporated the Engineering Exper... ce of the past and the knowledge of present requirements. This, naturally, results in Engineering Design for the Utmost in manufacturing Accuracy, Production and Economy of Operation.

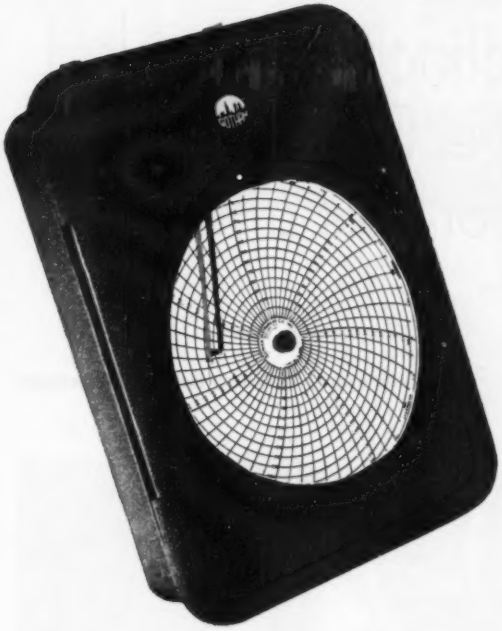
Ryan Aeronautical Company in using illustrations of machinery in their plant signify the pride and faith they place in their selection of outstanding manufacturing equipment.

Bullard Engineering Service is available to assist YOU with manufacturing problems. Call on this Service and Know more about the Bullard Line of Machine Tools as applied to your work.

Write for Complete Information



CHECK THESE 3 WAYS YOU CAN SAVE WITH THIS MULTI-PURPOSE INSTRUMENT



Here is the most sensible idea you've ever seen in a recorder or controller—an instrument you can change as your instrument needs change, that you can add to, subtract from, or whose functions you can increase or decrease at little or no expense.

✓ **Save money when you add new functions by adding only those new assemblies needed.**

✓ **Save time-delays by making changes on the job site without returning to factory.**

✓ **Save money on inventory. Parts are interchangeable, fit all Gotham Convertible recorders. You can service a whole group with a minimum stock of basic elements.**

What you can do with the Gotham Convertible

Depending on the chart size of the recorder (6", 9" or 12") you can have a 1-2-3 or 4 pen recorder with 14 pressure, temperature and time operation combinations or a recorder-controller with 38 possible pressure, temperature, and time combinations.

SELF-CONTAINED PORTABLE RECORDER

A portable recorder which has a carrying handle, legs and retaining holder for capillary and bulb. Built from Gotham standard elements, interchangeable with other Gotham instruments. 6", 9" and 12" chart sizes. Mercury, Vapor or Pressure Activated. Spring or electric chart drive. See Catalog 400.

RECORDING PSYCHROMETER

Incorporates the same highly accurate and responsive thermal systems and contains all other Gotham standard convertible features. Wet and dry bulb type. Motor-driven suction fan. 12" chart size. Catalog 400.

RECORDING HYGROMETER

A 2-pen recorder of the wet and dry bulb type. Mercury or Vapor Actuated. 9" and 12" chart sizes. Available with variety of wet and dry bulb assemblies depending on application. Catalog 400.

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Keep everything under control with Gotham

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Please send me a copy of your

- ☐ Catalog 100—Industrial Thermometers
- ☐ Catalog 200—Dial Type Thermometers
- ☐ Catalog 400—Recorders, Psychrometers, Hygrometers
- ☐ Catalog 500—Controllers
- ☐ Have your representative call. No obligation.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

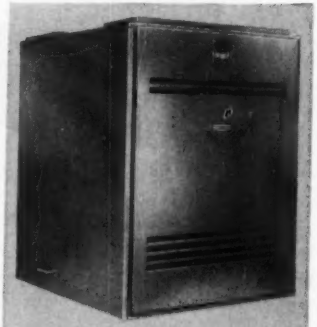
"Customer reaction clinched the No. 1 performance spot for this unit"

says P. V. Cheli,

Bryant, Chicago Branch Manager

It's too easy these days to make *claims* about any product. And it's mighty tempting to cut prices at the expense of quality, too. Personally, I judge *heating* equipment strictly on performance and the reactions I get from my customers. In the case of the Bryant Forced Warm-Air Furnace, customer reaction has certainly proved this unit is the star in its field. Actually this isn't any surprise at all, because the basic engineering and construction that have been put into the Bryant Model 87 have produced advantages that are unsurpassed in any other warm-air unit. Consider, for example, the enviable record for reliability and economical operation that Bryant Controls and Automatic Pilot have built up. And don't forget the Bryant *Hevigage* (12-gauge steel) heat exchanger . . . rugged . . . designed for the fastest and most efficient heat transfer. Almost three times thicker than minimum AGA requirements, too.

If you're not already acquainted with the features and performance of this popular Bryant unit why not get a firsthand story from some Bryant customers. Or write Bryant Heater direct for complete information. Bryant Heater Division, Dept. 122, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland, Ohio.



Bryant Model 87
Winter Air Conditioner

Gas-fired, forced warm-air furnace. Available for all gases. AGA inputs from 60,000 to 375,000 Btu per hour. Has *Hevigage* (12-gauge steel) heat exchanger. Sturdy, compact construction. Handsome gray exterior.

bryant *best buy*

IN HEATING,
AIR CONDITIONING,
WATER HEATING

EVERY SEALMASTER BEARING

Pre-Lubricated

1. PERMANENTLY SEALED
Felt-lined steel flinger, rotating in labyrinth, excludes dirt and retains proper amount of lubricant.

2. SELF-ALIGNING
Bearing unit, with seals independent of housing, can align itself in any direction without seal distortion.

3. PRE-LUBRICATED
Before shipment from the SealMaster factory, the bearing chamber is filled with proper amount of lubricant.

4. NO HOUSING WEAR
Patented locking pin and dimple prevent rotation of outer race in housing. This eliminates housing wear, permits shaft alignment and positions unit for relubrication.

5. FLOATING RETAINER
Ball retainer is designed to float on ground inner surface of outer race. Traps lubricant, prevents churning.

6. HOUSING DESIGN
SealMaster's cast housings combine rigid, one-piece construction with smooth streamlined appearance.

Bearing maintenance at low cost is a feature worth designing into your machines. In SEALMASTERS the lubricant is sealed-in at the factory. Thus, SEALMASTER Ball Bearing Units assure smooth operation, and long life—with reduced power consumption.

Ask for Catalog 845—for complete data on SEALMASTER *Bearings.*

SEALMASTER BEARINGS
47 RIDGEWAY AVENUE, AURORA, ILLINOIS
A DIVISION OF STEPHENS-ADAMSON MFG. CO.

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

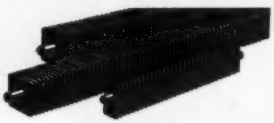
Economical from the start

. . . because it's

EASY TO INSTALL

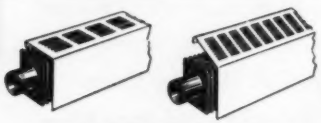
VULCAN

A VULCAN fin-tube installation is economical because less piping is required. Pressure tube with fins imbedded makes up the Vulcan Radiator unit, extending the heating surface without proportionately increasing the size.

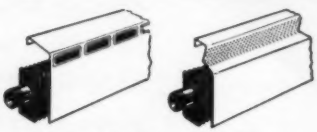


COMES CUT to length, increments of 1′ to 12′. Steel pressure tube with steel fins; copper water tube with copper or aluminum fins. Ends threaded or chamfered for welding.

SAVES TIME — Radi-vector Baseboard suspended from Vulcan Backing by sturdy patented Rod Hanger. No holes to drill. Commercial Radiation (unit and cover) suspended on Linovector hanger. Requires only 2 holes per bracket.



Commercial Radiation for Schools, Hospitals, Commercial and Industrial Buildings.

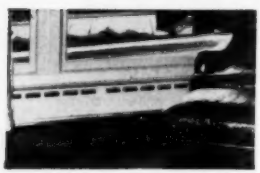


Radi-vector Baseboard for Homes and Offices.

COVERS, complete with Closed Ends, Joining Pieces and "Flexi-Corners". Designed for style, engineered for ease of installation.

Send for Commercial Radiation Bulletins Nos. 125, 60. Radi-vector Baseboard Bulletin No. 53A

Made in Canada, under trade name of Heal Radiation, by the Vapor Car Heating Co. of Montreal.



VULCAN RADIATION

A Product of the **VULCAN RADIATOR CO.,** *16 Francis Ave., Hartford, Conn.*

Over 25 Years A Leader Ⓥ *in Fin-Tube Radiation*

Success Story [OVER 20 YEARS ENGINEERING KNOW-HOW AND EXPERIENCE
OVER 18,000 SUCCESSFUL INSTALLATIONS FROM COAST TO COAST

The HEART of any Air Conditioning Unit is the COIL

ALL COPPER FINS AND TUBES
TUBES BOTH EXPANDED AND SOLDER BONDED TO FINS
TIN DIPPED HEADERS
⅝" OD TUBES IN STAGGERED ROW CONSTRUCTION
EXPENSIVE SIL-FOS USED FOR SOLDERING
ALCO EXPANSION VALVE INCLUDED
DISTRIBUTOR HEAD METERS REFRIGERANT EXACTLY THROUGH ENTIRE COIL
FLOOR MODELS 600 CFM TO 2,200 CFM
ZEPHYR 600 CFM
UTILITY MODELS 1,000 TO 3,000 CFM
CENTRAL PLANTS 4,000 TO 12,000 CFM

HASTINGS Air Conditioning Units feature Coils with 100% Copper Fins and Tubes

HASTINGS
AIR CONTROL . . . THE PROVEN ECONOMY LINE THAT BUILDS PROFITABLE YEAR-ROUND VOLUME

- All Direct Expansion Models are equipped with Alco Expansion Valves
- Water units with 6-row coils for use with city water at 60° or less; chilled or well water — from 600 to 12,000 CFM
- Each unit complete with motor, drive and filters
- No other coils have all the HASTINGS qualities which contribute to MAXIMUM EFFICIENCY and long life.

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Engineering design and capacity ratings permit quick and simple selection of equipment for the job.
COMBINATION cooling and heating units for steam or hot water.

GAS UNIT HEATERS
Complete line 75,000 to 200,000 BTU.
AGA approved.

IMMEDIATE DELIVERY

INVESTIGATE NOW
We guarantee that you will find the line of HASTINGS COOLING, HEATING AND VENTILATING EQUIPMENT to be exceptional in performance, quality and appearance.

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SALES DIVISION OF HASTINGS AIR CONDITIONING CO.
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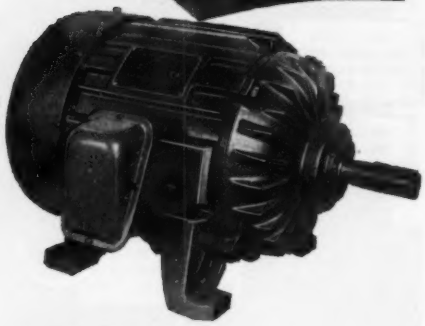
Catalogue on .....DX, ...Water, ...Gas Unit Heaters
Prices on .....DX, ...Water, ...Gas Unit Heaters
We are a.....Dealer, ...Distributor, ...Sales Agent
(DESIRABLE TERRITORIES AVAILABLE)
Name.....
Address.....City.....State.....
(PLEASE ENCLOSE YOUR LETTERHEAD WITH INQUIRY)

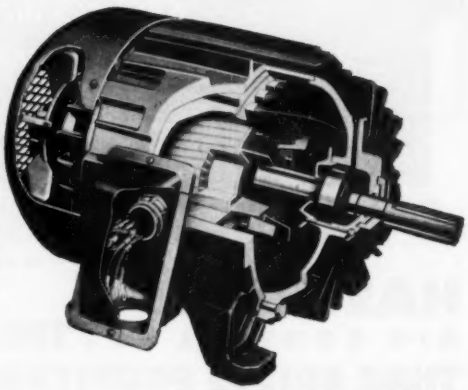
Totally-Enclosed
Fan-Cooled

Look Outside



Greatly increased radiating area means greater cooling efficiency. More important, cooling efficiency stays high, regardless of operating conditions. There are no enclosed external air passages to clog and cause overheating. If oily dirt sticks, just wipe or blow it off. No matter how bad operating conditions are, this motor can be easily kept clean and cool running. Electrical parts are protected against corrosive atmospheres by cast iron yokes and end housings.

Look Inside



Double-shielded, heavy-duty ball bearings require no maintenance in ordinary service under most conditions. However, they can be lubricated without disassembly if required. Double shielding prevents over-lubrication, leading cause of bearing trouble. Rotating seals, where shaft extends through housings, keep dirt and moisture out of bearing chambers. Die cast rotor and interphase insulation are further assurance of long life and low maintenance.

See WHY THIS IS YOUR BEST MOTOR BUY

HERE IS A MOTOR that is different from conventional TEFC motors; built with an entirely different cooling system that gives you big savings in lower maintenance, more continuous service and less trouble in the toughest locations. Clogging can easily be prevented in the Allis-Chalmers Type APZ TEFC motor since areas that might collect dirt are exposed and easy to clean.

GET DETAILS NOW — *Ask your nearby Allis-Chalmers Authorized Distributor or District Office for more complete information on this high performance TEFC motor. Or write direct to Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225.* A-3578

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

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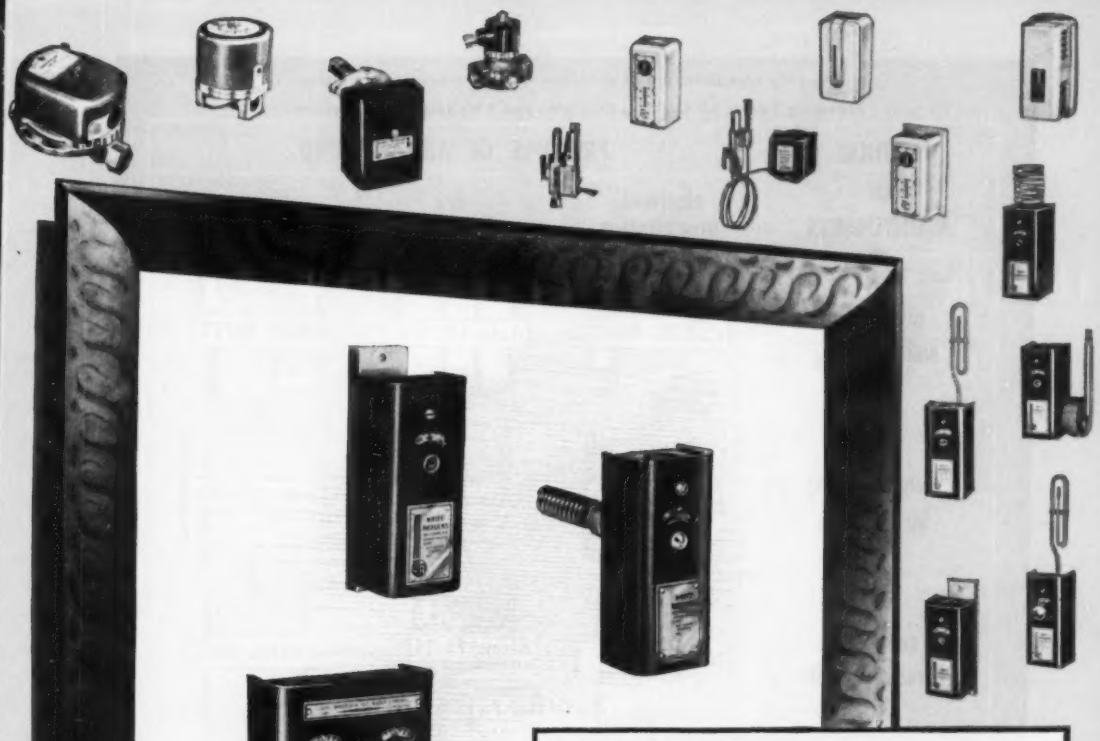
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.



HOT WATER CONTROLS FOR EVERY NEED

These Hydraulic-Action Controls by White-Rodgers provide exceptionally quick response to changes of water temperature. Positive in setting, free from temperature drift and easy to install, they provide unusually close control with narrow temperature differentials.

Available in surface (strap-on), well-immersion (vertical or angle), super-fast direct-immersion and remote bulb types.

For those applications requiring relays, try a White-Rodgers Relay with built-in transformer, available in a wide variety of contact actions.

Write today for complete catalog and installation information

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WR Controls — FOR REFRIGERATION HEATING AND AIR CONDITIONING

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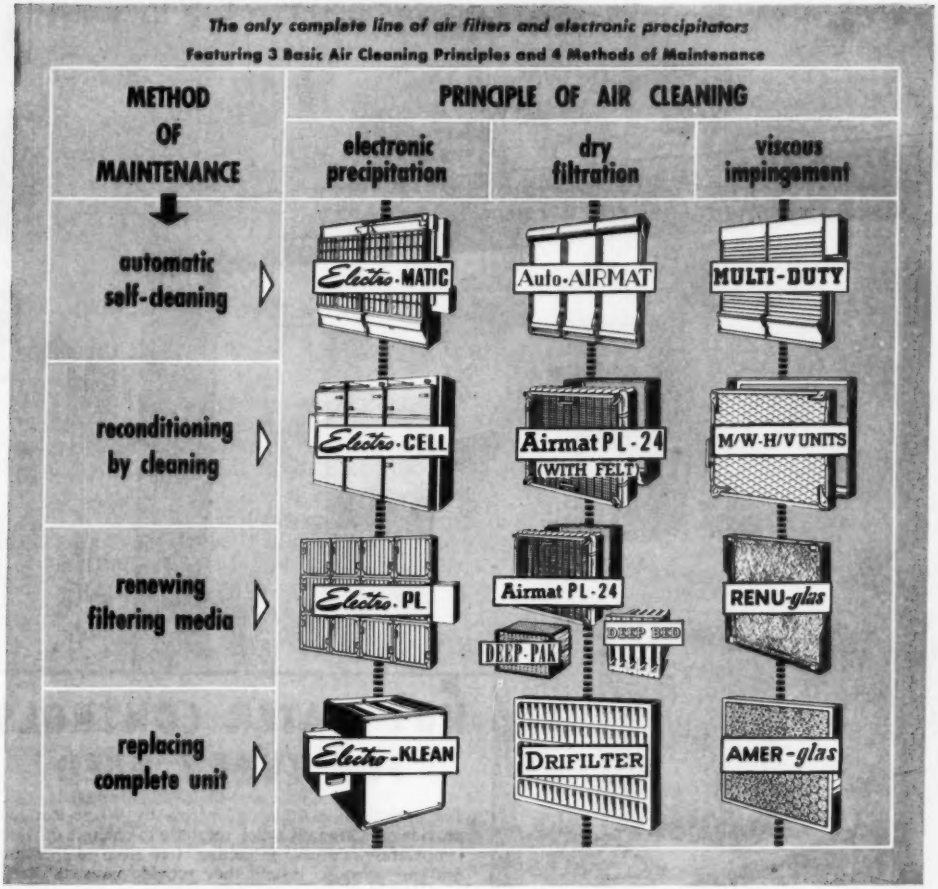

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. . . Select from the ONLY COMPLETE LINE of air cleaning products

Engineered air cleaning equipment is the practical answer for today's complex problems of air contamination. This is the advantage offered by AAF's complete line, which includes more than twelve distinct air filter types. These range from the highly technical electronic precipitator to simple replaceable units . . . many of them being exclusive AAF developments. Each type is distinguished by its principle of cleaning air or method of maintenance, thus allowing the engineer wide latitude in selection to meet individual requirements.

If you require *clean air* . . . look to AAF for the most practical and efficient answers. AAF representatives located in all major cities will be glad to serve you, or write us for our new 32-page "Composite Catalogue"—American Air Filters—Bulletin 510.

AAF

American Air Filter
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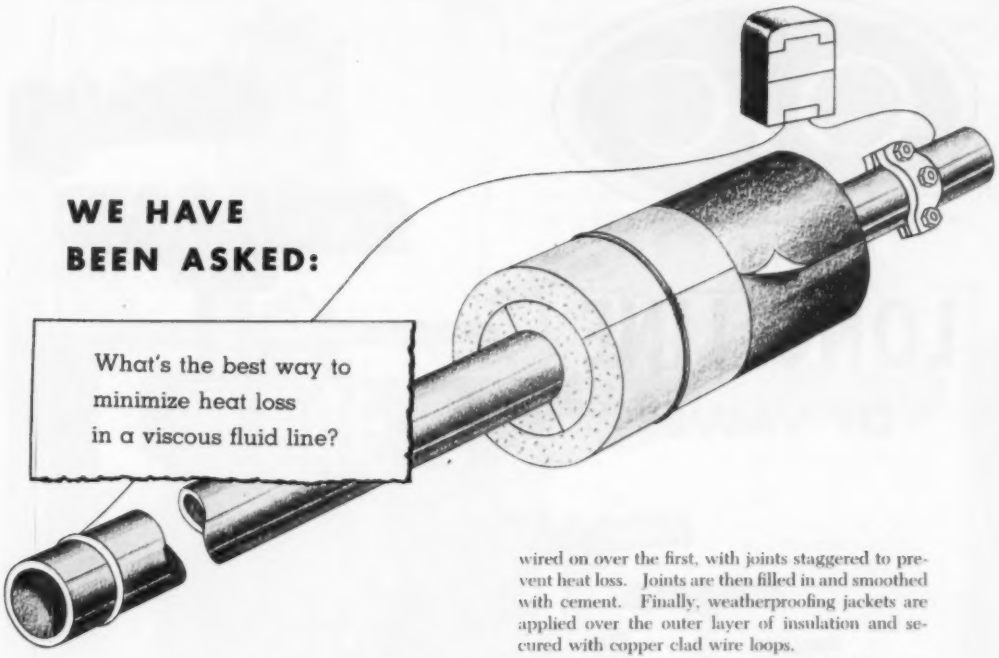


WE HAVE BEEN ASKED:

What's the best way to minimize heat loss in a viscous fluid line?

We recently received a letter which posed this problem:—"How should we insulate a 3" outdoor pipe line which carries asphalt approximately one thousand feet from a storage tank to the processing operation? The asphalt leaves the heated tank in a fluid state at 450° F. and must be kept above 435° F. to insure proper flow."

With this great length of pipe, insulation alone cannot be expected to hold the temperature above the 435° minimum. Should occasional shutdowns occur, no practical amount of insulation will prevent the asphalt from solidifying in the line, particularly in cold weather. Some method of applying heat to the pipe such as charging it with low voltage electricity or using a steam tracer line is recommended. This will keep the pipe warm enough to maintain proper temperature and keep the asphalt fluid, regardless of interruptions in the flow. The line should then be insulated with Double Standard 85% Magnesia according to standard specifications.

The pipe covering is applied in two layers, the first being securely wired in place. The second layer is wired on over the first, with joints staggered to prevent heat loss. Joints are then filled in and smoothed with cement. Finally, weatherproofing jackets are applied over the outer layer of insulation and secured with copper clad wire loops.

85% Magnesia is ideally suited to this and a variety of other jobs for temperatures up to 600° F. It has proved its outstanding insulation efficiency and durability through years of trouble-free service. It offers great mechanical strength, will give top performance even under severe conditions. Yet it is lightweight, easy to apply, and completely fireproof.

Next time you're up against any insulation problem, contact your near-by Armstrong office. The technical advice of an Armstrong engineer is always available to you with no obligation. The Armstrong organization can take over the entire job for you—furnish the correct materials for your particular job and the skilled workmen to apply them properly. Our complete insulation service can save you time, trouble, and money—and you'll be **sure** of having a thoroughly professional job!

SEND US YOUR QUESTIONS. If you have any question on insulating materials or their use in high-temperature installations, please write us. We'll see that you get a prompt, practical answer. Just address your letter or post card to Armstrong Cork Company, 4405 Maple Avenue, Lancaster, Pennsylvania.

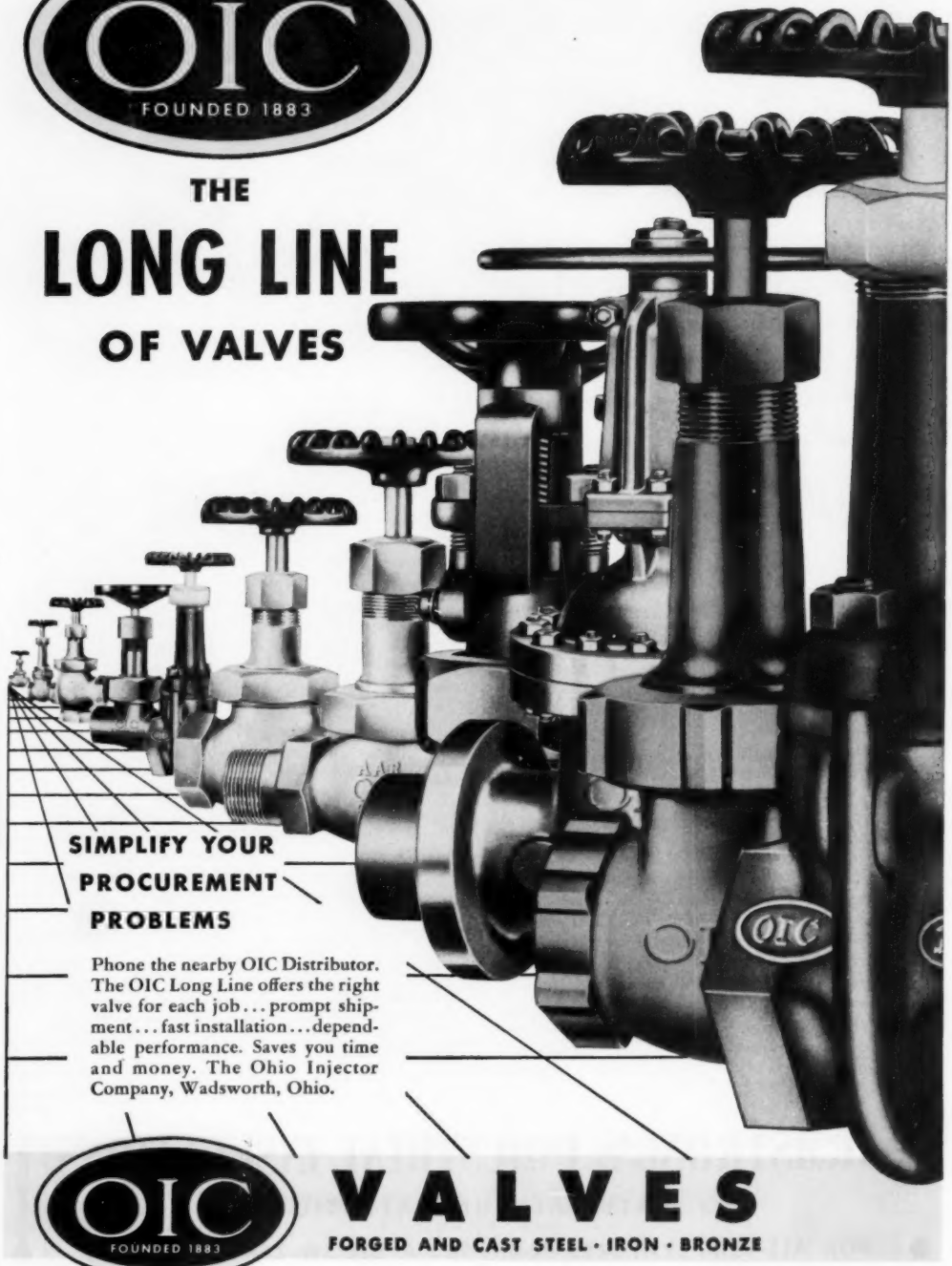
ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

OIC
FOUNDED 1883

THE
LONG LINE
OF VALVES

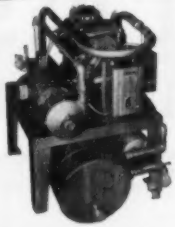


SIMPLIFY YOUR
PROCUREMENT
PROBLEMS

Phone the nearby OIC Distributor. The OIC Long Line offers the right valve for each job... prompt shipment... fast installation... dependable performance. Saves you time and money. The Ohio Injector Company, Wadsworth, Ohio.

OIC
FOUNDED 1883

VALVES
FORGED AND CAST STEEL · IRON · BRONZE



FLOW-COLD* LIQUID CHILLERS

Self-contained, compact and efficient Units, furnished completely wired and with refrigerant piping completed at the Factory. For Industrial applications or for Residential uses, ACME FLOW-COLD Units are simple and easy to install and will give lowest cost, most efficient cooling. Can be used for Heat Pump application where a suitable heat source is available.

In selecting the most efficient equipment to perform a specific job of refrigeration, your task is greatly simplified when you specify "ACME" — for the ACME line is complete enough to give you a suitable ACME Product, for every kind of Residential or Industrial chilling or liquid cooling requirement. And you are certain of getting the most practical, maintenance-free, low cost operation, for ACME equipment has been preferred in the heavy Refrigeration Industry for more than 30 years.

ACME DRY-EX* CHILLERS

For brine, alcohol, water or any low viscosity fluids. There are more than 700 combinations of refrigerant heads, baffle spacings and tube lengths. The most efficient direct expansion, shell and tube units offered to the Refrigeration Industry in the last 10 years.

ACME products

tailored to fit every kind of LIQUID CHILLING or WATER COOLING JOB

ACME ALSO MANUFACTURES: EVAPORATIVE CONDENSERS • FREON CONDENSERS • AMMONIA CONDENSERS • SHELL AND COIL CONDENSERS • SHELL AND TUBE CONDENSERS • FIN COILS • PIPE COILS • COOLING TOWERS • OIL SEPARATORS • LIQUID RECEIVERS • HEAT EXCHANGERS

UXR DRY-EX* WATER CHILLERS

For smaller loads, ACME has available the UX and the UXR type DRY-EX models, with both fixed and removable tube bundles. For applications involving brine, glycols, liquid sub-cooling or inter-stage condensing, consult factory for additional information and recommendations.

HI-PEAK* WATER CHILLERS

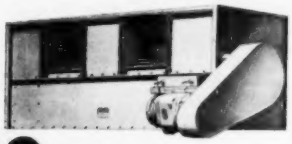
Are offered in seven standard sizes, for intermittent or continuous operation. HI-PEAK Water Coolers have large storage capacity and are galvanized after fabrication. Factory Insulation optional. Equally efficient for use with Freon or Ammonia, require a separate Compressor, as it is not a self-contained cooling unit.

ACME PRODUCTS

Acme INDUSTRIES, INC. JACKSON, MICH. U.S.A.

CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1919

YOUNG SECTIONAL DESIGN
PROVIDES MAXIMUM AIR CONDITIONING UNIT FLEXIBILITY



1 FAN SECTION

Centrifugal multiblade fans are properly balanced for quiet operation. Air discharge direction alterable. Shaft extensions provided for left or right hand drive.

2 HEATING COIL SECTION

Heating coils are available for use in hot water or steam systems. Copper tube non-ferrous finned coils are available in two sizes for each unit.

3 DAMPER SECTION

"YAC" Units can be furnished with either face and by-pass dampers, face and external by-pass dampers, or no dampers as required for the specific air conditioning job.

4 BASE & COOLING COIL SECTION

Continuous serpentine or cleanable type water, or direct expansion cooling coils are available in two sizes for each unit. Spray, grid, or pan type humidifiers are optional equipment.

5 FILTER SECTION

Dry throw away or cleanable type filters are serviced through access panels which are conveniently located on either right or left side of the unit, as desired.

Young sectional design enables you to provide partial or complete air conditioning service at low cost. Whether your requirements call for simple heating or cooling—or, heating, cooling, humidifying, dehumidifying, circulating, and filtering *in any combination* —you can meet them exactly with Young "YAC" Units. Eight compact sizes, in horizontal or vertical types, are designed for right or left hand installation. Air may be discharged in any direction by rotating and interchanging fan section panels. Young sectional design also means greater ease in handling, installing, and servicing.

Young sectional design is completely described in "YAC" Catalog 7550 which will be sent upon request.

YOUNG

Heating, Cooling, Air Conditioning Products for Home and Industry.

Heat Transfer Products for Automotive and Industrial Applications.

YOUNG RADIATOR COMPANY

Dept. 512E • RACINE, WISCONSIN

Factories at Racine, Wisconsin and Mattoon, Illinois

Sales and Engineering Offices in all Principal Cities

MYSTIK

Self-Stik

DRI-PIPE

INSULATION

Holds Cold and Heat • Prevents Condensation

MYSTIK DRI-PIPE—the insulation with "self-stik" edges—goes on fast, saves time and money on installation. Ideal for low-temperature applications—on cold water lines, cold air ducts, refrigeration lines. Holds temperatures, prevents condensation and dripping, eliminates icing and frosting on refrigeration lines. Also has extensive other cost-cutting insulation uses—on warm water lines, warm air ducts and for sound deadening. Ask your supplier or . . .

WRITE NOW for free sample of MYSTIK Self-Stik DRI-PIPE Insulation to Mystik Adhesive Products, 2653 N. Kildare, Chicago 39, Ill.

MYSTIK CLOTH TAPES • MYSTIK PAPER MASKING TAPES • MYSTIK SPRA-MASK • MYSTIK PROTECTO-MASK • MYSTIK SAND-BLAST

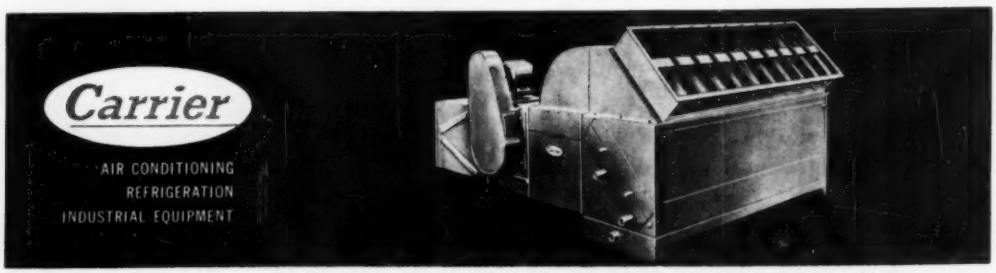
Air conditioning can be in concert too

If you've had problems air conditioning buildings that have a variety of heat loads, here's news that'll be music to your ears.

Our new Zoning Weathermaker is a year-round air conditioning unit that gives accurate temperature control of several different zones at the same time. A blow-through fan coil system, there are 14 possible zones available, each zone having a hot and cold damper placed at 90 degrees to each other, so one is closed when the other is open. And any degree of modulation is possible.

Sectionalized for easy installation, the Zoning Weathermaker can be suspended from the ceiling or floor mounted. And for greater flexibility of application, all piping connections can be made from either side.

This new Weathermaker joins Carrier's great family of products . . . products matched in size and performance to work together . . . products to meet every industrial or comfort air conditioning requirement you have. Carrier Corporation, Syracuse 1, N. Y.



The Carrier Zoning Weathermaker, available in 5 sizes with cooling coils in 4 or 6 row direct expansion . . . or 4, 6 and 8 row cooling coils for brine or chilled water. Cooling capacities from 15 to 80 tons, 4100 to 16,400 cfm.

DELCO
DAYTON OHIO

whatever the application,

you're right with a

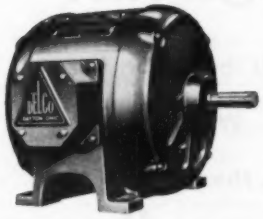
DELCO!

When your product requires the application of power—as a part of the product or to help make the product—you can be sure of complete satisfaction by choosing the Delco motor that's *built* for the job.

Every Delco motor that's made is engineered for the kind of *work* it has to do. It's made of the finest materials, and constructed to *stand up longer* under the roughest conditions.

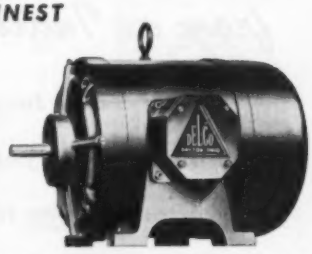
So get the facts on Delco motors *first.* You'll find Delco has the motors you need, and that Delco always meets its commitments. For complete details, write to Delco Products, Dayton, Ohio, or call the nearest sales office listed below.

DELCO FEATURES MAKE DELCO FINEST

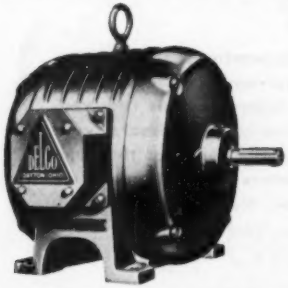


OPEN BALL-BEARING MOTOR

TOTALLY ENCLOSED FAN-COOLED MOTOR

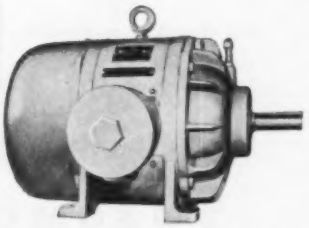


DELCO
DAYTON OHIO



TOTALLY ENCLOSED MOTOR

EXPLOSION-PROOF MOTOR



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SALES OFFICES: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DALLAS
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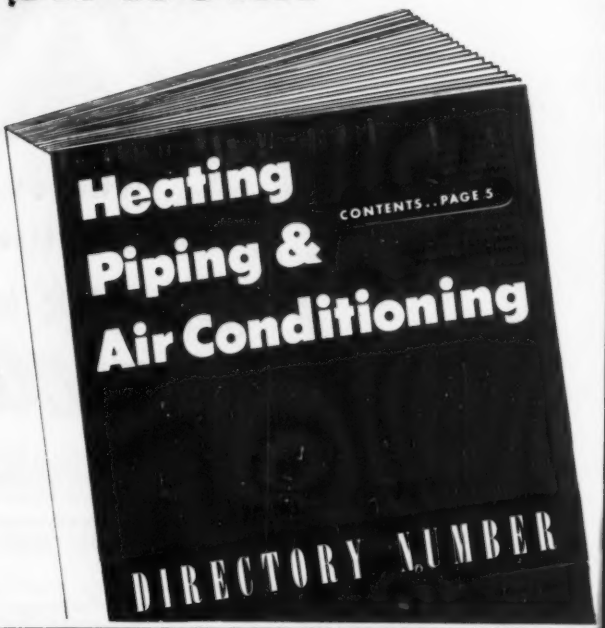
DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

"HELPFUL IN OUR WORK"

. . . that's How HP&AC Subscribers Rate the January Directory Edition



from an Indianapolis Consulting Engineer:

"Your January 1952 Directory issue will be kept here throughout the year. We refer to it almost daily. We consult the Directory section to find out who makes a product, then turn to the advertising pages for the detailed information we need."

90% of those HP&AC subscribers, answering a recent questionnaire, replied that they find the current Directory Number helpful in their work when product information is required. If you are a subscriber from whom we have not heard, your comments will be most welcome. As the result of this type response from engineers and contractors over the years, we feel that the Annual January Directory Number is a valuable part of *your* subscription to HP&AC. Do you agree?

FIRST *in Editorial . . . in Circulation . . . in Advertising*

2 New Uses for SPORLAN Catch-All FILTER-DRIERS!

FILTERING *instead of* STRAINING *plus* MOISTURE REMOVAL *on Comfort Cooling Refrigeration Systems*

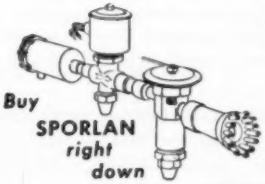
Yes Sporlan Catch-Alls with their tremendous Tri-dimensional filtering area have conclusively proved that they will remove foreign matter from the refrigerant quicker and better than strainers . . . and in addition, will remove the fine particles which no strainer can possibly do. At last you can be rid of these fine particles that cause so much abrasive damage to all moving parts of the system.

For many years it was believed that water in the refrigerant was no problem, because freeze-ups did not occur in comfort cooling. But today we know that the moisture in these systems causes corrosion, acidity, oil contamination and sludge. This condition becomes even more critical on hermetic compressors causing breakdown of insulation on the motor windings with resultant burn-outs. Here again only Sporlan Catch-Alls with their exclusive drying ability can remove the moisture, reduce the acidity and eliminate all the problems caused by moisture.

Here Are The 5 Exclusive Catch-All Filter-Drier Features That No Other Strainer or Drier Can Claim

1. They cannot powder!
2. They cannot pack!
3. The refrigerant cannot channel around the desiccant!
4. The unique, porous Catch-All cores are molded of minute particles of a highly efficient desiccant, the efficiency of which is greater than that of the same desiccant in granular form.
5. They dry down to a low end point . . . a point so low that any remaining moisture is absolutely harmless!

When you want perfectly clean, perfectly dry refrigeration systems . . . Install Sporlan Catch-Alls, the perfect Filter-Drier, and get Peak Performance on All Installations.



Buy SPORLAN *right down the line!*

SPORLAN VALVE COMPANY

7525 SUSSEX AVE. ST. LOUIS 17, MO.

EXPORT DEPARTMENT
89 BROAD STREET NEW YORK 4, N. Y.

CLIMATE DICTATED THIS HOUSE

Now You Can Dictate the Climate With YORK RESIDENTIAL AIR CONDITIONING

Only YORK Gives You All 8

- **Faster Cooling!** Unique Cooling Maze Coil cools and dehumidifies faster.
- **Better Heat-Humidity Balance!** Step-Matic Control dehumidifies without overcooling.
- **Lowest Maintenance Costs!** Completely Hermetically Sealed Refrigerating System is trouble-proof.
- **Lowest Operating Costs!** Capillary tube refrigerant feed, plus step-starting relay, reduces starting current needs.
- **Lower Installation Costs!** Adaptable to any heating system.
- **Lower Cleaning Costs!** 2 heavy filters comb dirt, dust, soot, pollen from air.
- **Quieter Operation!** Built-in compressor mufflers, cushion mountings and acoustically treated cabinet reduce operating sound to a minimum.
- **York's Five Year Protection Plan!** Your assurance of trouble-proof performance.

Now you can easily solve the problems of "hot-weather planning."

York Residential Air Conditioning—for conditioning entire homes with compact, central installations—can be your answer to heat, humidity, ventilation, circulation, dirt, dust and pollen.

There are seven York Residential Air Conditioners—for every size and type of residence. And for every kind of installation—attic, service closet, garage, basement—giving you complete freedom of design. With York you exercise freedom, too, in your choice of heating plant—because York can be adapted to any type, whether it be a forced warm air system, a gas-fired steam system, or a coal-steam or an oil-fired hot water system.

For full information on the versatile York Residential Air Conditioner . . . and how much easier it makes your task . . . call your York Representative (he's listed in the Classified Directory). Or write to York Corporation, York, Pennsylvania.

York refrigeration air conditioning

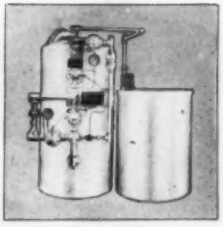
The big advances come from YORK

Headquarters for— **Refrigeration and Air Conditioning**

BRUNER

WATER CONDITIONING & PUMPING EQUIPMENT

Engineered to the job



Heavy-duty models — 80 to 160 gpm. 600,000 to 1,200,000 gr. cap. Carried in stock. UPPER LEFT, Sole Valve. UPPER RIGHT, Dial-O-Matic. LOWER RIGHT, Brucox Feeder for corrosion control and prevention of red water. Write Dept. HPA for catalog.

Pictured on the job at the Methodist Hospital of Central Illinois at Peoria, Illinois is a BRUNER Industrial heavy-duty model engineered to produce 70,000 gallons of pure soft water from water of 26 gr. hardness. This installation is another example of BRUNER design and manufacturing craftsmanship that assures absolute satisfaction.

●

It will pay you to get the recommendations of the Bruner Corporation laboratories if you have a problem in the field of water softening, filtering or conditioning. Your inquiry will receive prompt attention. Of course, there is no obligation.

"America's Most Complete Line of Quality Water Softeners and Filters"

NORTH
SOUTH
EAST & WEST

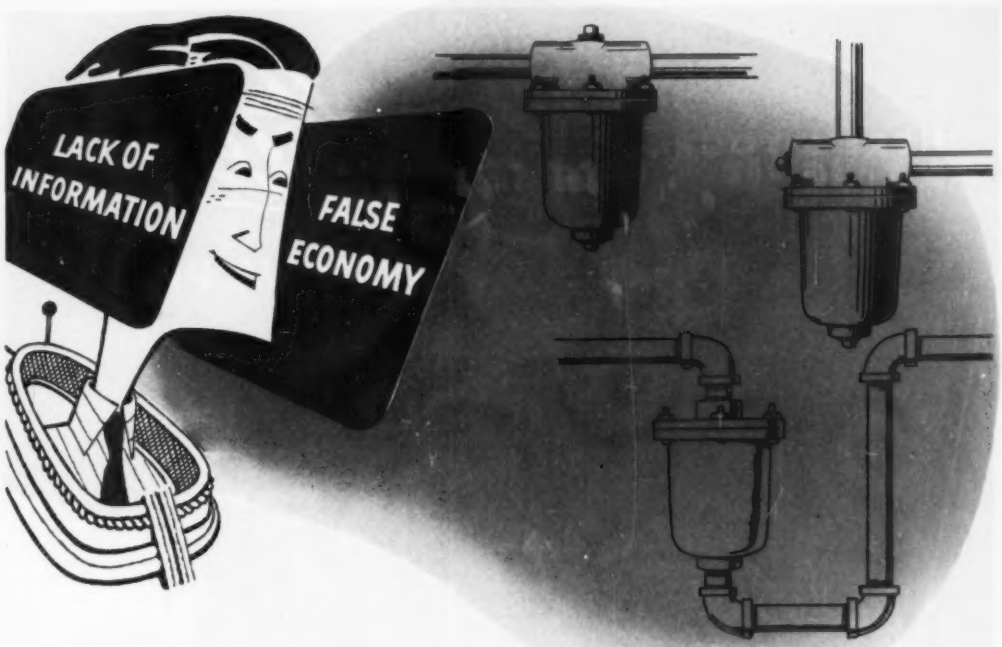
Plumbers all over the U.S.A. know a good thing when they see one. That's why Wheatland Precision Couplings have made friends in every state of the union. Wherever men know pipe and demand the best in couplings, you'll find Wheatland Precision Couplings on the job—saving *time, trouble, money.*

- *Clean outside finish*
- *Continuous even depth thread*
- *Deep round chamfer*
- *Heavy galvanized coating*
- *Pressure tested*
- *Prompt delivery.*

precision couplings by

WHEATLAND STEEL PRODUCTS COMPANY
BANKERS SECURITIES BLDG., PHILADELPHIA 7, PA.

Get in the scrap for defense. Spot-check your plant today!



BEFORE BUYING STEAM TRAPS

REMOVE THE BLINDERS

Before you install new Steam Traps or replace worn out traps, be sure you are not bothered by "lack of information" or "false economy" blinders. Many replacement trap buyers *are* hindered by false economy . . . believing it cheaper to continue using their present old style trap. Remove all trap buying blinders . . . send for your copy of "Solving Steam Trap Problems" today. Check the economy features of replacing present systems with Anderson Super-Silvertop Steam Traps. You'll find they cost no more than most ordinary traps . . . yet Super-Silvertop Steam Traps can be serviced without removing the trap from the line, saving 30 minutes service time. Note too, that the valve and seat are made of longer lasting Anderloy* alloy . . . with the bucket guided on a center tube, eliminating bucket damage and costly repair. 3 pipe connections in the head allow the trap to be installed straight-in-line or as an elbow saving up to 50 minutes installation time and as many as 7 fittings.

For the complete story on trap economy, be sure to mail the coupon for booklet today.

*Trade Mark Registered in U. S. Pat. Off.

SUPER-SILVERTOPS SAVE MONEY

THE V. D. ANDERSON COMPANY
1949 West 96th Street · Cleveland 2, Ohio

Gentlemen: Please send without obligation "Solving Steam Trap Problems."

Name .....

Address .....

City ..... *State* .....

In Canada: Bawden Industries, Ltd. Toronto

HERE'S YOUR *Complete* STEAM PLANT

- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
- For complete details, write today for catalog 404.

SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES, Inc.

Factory: Emmaus, Pa.

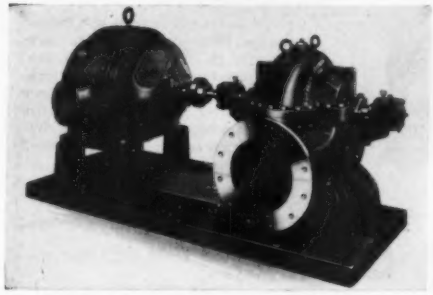
Executive Offices: Times Building, Times Square, New York 18, N. Y.

"Buffalo" *Tips on Better Pumping*

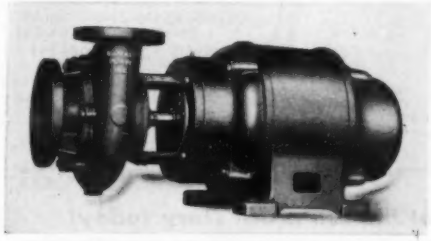
REGULAR PREVENTIVE MAINTENANCE

Keeps Your Pumps Performing!

FOR BOILER FEED or other high pressure or clear water service. Buffalo Type "RR" Pumps have proven themselves to be high in efficiency and easy to maintain 2 and 4-stage models, up to 900 gpm capacities.



"Buffalo" Type "SL" Double Suction Pumps are among the most popular for humidifier and air washer service.



CLOSE-COUPLED for cramped quarters! The Type CCL Pump is one of many models to suit specific needs.

• Even the best constructed pumps require regular servicing for efficient performance and long life.

The best way to insure the success of a preventive maintenance program is to set up a regular schedule for servicing and inspection. A qualified engineer who knows pumps and lubricants should be the one to set up this schedule.

The schedule would call for at least four inspections of each pump annually, to check on bearings, shaft alignment, packing, impeller and lubrication. The inspector makes a report of any conditions which need correcting — conditions requiring servicing, to the operating group; conditions requiring repairs, to the maintenance group. (Often, these reports prevent minor conditions from developing into major troubles).

The schedule for lubrication, as well as any operating instructions, should be posted plainly on or near each pump.

This is another in a series of messages by Buffalo Pumps, Inc. in the interest of conserving materials and industrial equipment.

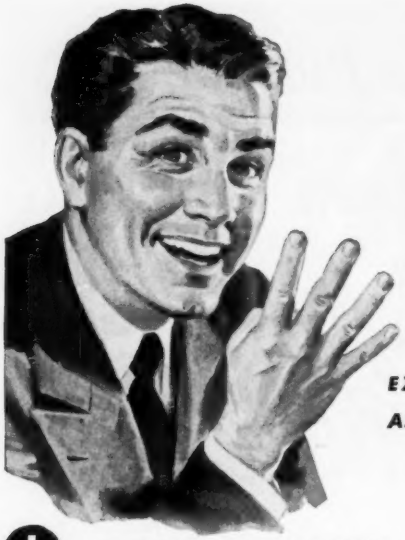
"Buffalo"

BUFFALO PUMPS INC.

171 MORTIMER STREET BUFFALO, NEW YORK

Canada Pumps Ltd., Kitchener, Ont. *Sales Representatives in All Principal Cities*

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



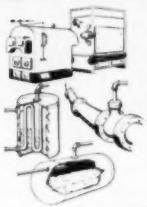
You're ahead 4 ways when you

SELL SERVEL

AIR CONDITIONING EQUIPMENT

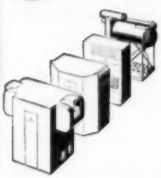
EXCLUSIVE ADVANTAGES OF SERVEL "ALL-YEAR" AIR CONDITIONING OPEN NEW SALES POSSIBILITIES . . . NEW TOP-PROFIT INSTALLATIONS TO YOU!

1 Servel offers the widest choice of energy source



With the addition of oil-fired units, Servel now has a line of air conditioning units that enable you to sell your prospect an air conditioner that uses the most economical energy source available. Only Servel provides you with air conditioning units that operate on gas, oil, LP gas, waste heat or steam from any source, any pressure.

2 Full range of models to fit your entire market



The full range of Servel air conditioning equipment enables you to sell every prospect from the residental and small commercial buyers to the large commercial, industrial and military type installations. The 25-ton Water Chiller especially opens up new sales opportunities in the industrial and military field where large equipment is needed for cooling and process work.

3 Servel "no moving parts" design cuts maintenance cost

Operating on the famous absorption principle, Servel units require no moving parts in their cooling systems. They deliver quiet, continuous, vibrationless operation at peak performance . . . year after year . . . and, because there is nothing in their cooling systems to wear out, require a minimum of maintenance!

4 Servels have a five year factory warranty

The perfected Servel absorption refrigeration unit is warranted for five full years! This warranty is your assurance of Servel quality and dependability.

Servel air conditioning offers low operating costs, proven dependability, vibrationless operation—and an exclusive 5-year warranty.

SELL SERVEL . . . the air conditioning that offers low operating costs, guaranteed dependability in home, commercial or industrial installations.

RESIDENTIAL COMMERCIAL INDUSTRIAL

Servel

AIR CONDITIONING

Made by the makers of the famous Servel Refrigerator

SERVEL, INC. • Evansville 20, Indiana

Get the full profit story today!

Servel, Inc., Dept. HPAC-5, Evansville 20, Indiana

Gentlemen:

I'm interested in making more money selling Servel Air Conditioning. Rush me additional information on the exclusive Servel sales and profit advantages!

Name _____

Firm _____

Address _____

City _____ *Zone* _____ *State* _____

SEND FOR THE NEW p-k 40 PAGE WATER HEATER CATALOG

p-k catalog No. 202 provides you with a simple, rapid means of selecting the correct hot water heater for forced circulation.
Capacities from 95 to 101,000 gph.
Steam pressures range from 0 to 100 psig.
Standard "U" Tube Heaters are available in 2- 4- or 6-pass construction.
Water temperatures range from 40° to 100°F. inlet and 80° to 300°F. outlet.

1035

other TAB INDEX FEATURES

- **Condensate Cooler tables**
- **Dishwater Booster Heater tables**
- **Gravity circulation tables**
- **Hot Water Service Heater tables**
- **Pressure drop tables**
- **Typical piping arrangement**

the p-k **please send p-k catalog 202**

Patterson-Kelley Co., Inc.

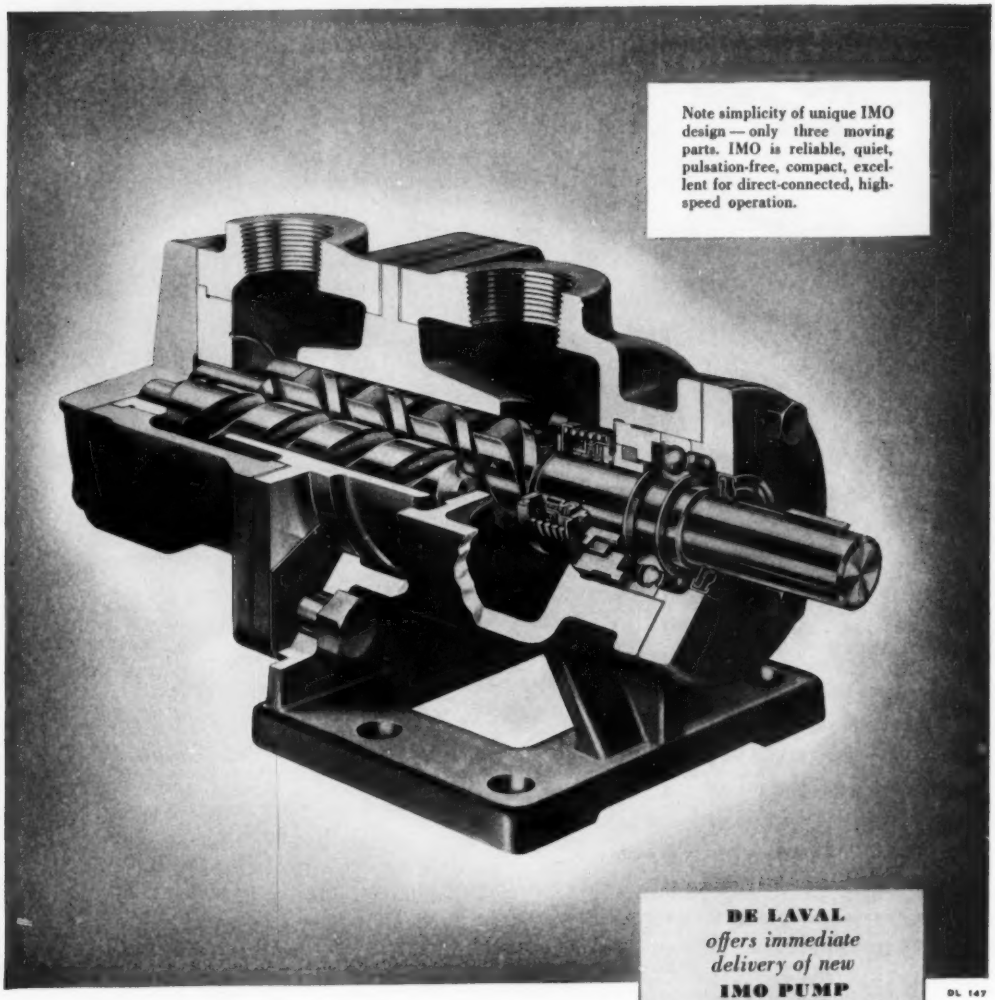
91 BURSON ST., EAST STROUDSBURG, PENNA.

Name _____ Position _____

Company _____

Street _____ City _____ State _____

Newest IMO pump – Greatest savings



Note simplicity of unique IMO design — only three moving parts. IMO is reliable, quiet, pulsation-free, compact, excellent for direct-connected, high-speed operation.

DE LAVAL
offers immediate delivery of new
IMO PUMP
Write today

DL 147

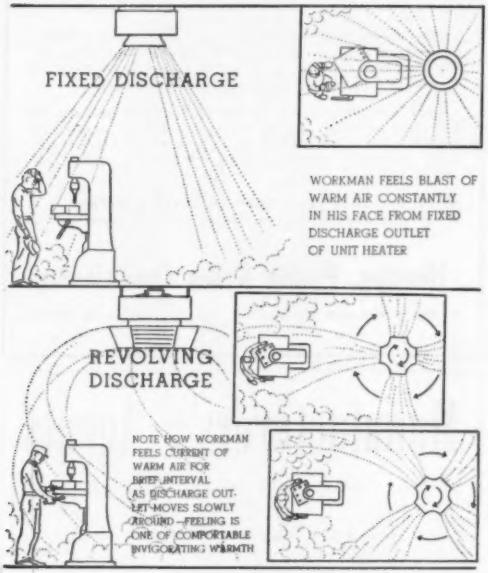
This newest De Laval IMO pump — Model A313B — can be used profitably on a wide variety of hydraulic applications for higher pressures. Quantity-produced to help trim your costs, the new IMO saves you up to 40% in initial cost over other IMO models for pressures up to 275 psi. In addition, this quality-designed rotary positive displacement pump gives you all the low-maintenance advantages of the famous IMO pumping principle.

Put the new De Laval IMO A313B pump to work handling light or viscous fluids in hydraulic systems, rotary and steam atomizing oil burners, lubrication, governing systems and similar services. Specify it for capacities to 80 gpm, pressures to 275 psi and intermittent pressures to 325 psi.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

What is the BIG difference between revolving and fixed unit heater discharge outlets? • • • •


FIXED DISCHARGE
WORKMAN FEELS BLAST OF WARM AIR CONSTANTLY IN HIS FACE FROM FIXED DISCHARGE OUTLET OF UNIT HEATER
REVOLVING DISCHARGE
NOTE HOW WORKMAN FEELS CURRENT OF WARM AIR FOR BRIEF INTERVAL AS DISCHARGE OUTLET MOVES SLOWLY AROUND—FEELING IS ONE OF COMFORTABLE INVIGORATING WARMTH

WING REVOLVING UNIT HEATERS are successfully solving the heating problems of thousands of industrial plants today because they assure a uniform, comfortable temperature throughout, with no hot blasts, no cold spots, no chilly corners. Instead of annoying hot blasts, the worker is conscious only of a pleasing sensation of fresh, live, invigorating warmth.

L. J. Wing Mfg. Co.
140 Vreeland Mills Road, Linden, N. J.
In Europe: Etab. WANSON, Haren-Nord, Brussels, Belgium
Factories: Newark, N. J. and Montreal, Canada

Wing
REVOLVING UNIT HEATERS

Write for a copy of Wing Bulletin HR-6, which discusses in detail the problems of industrial plant heating and in particular the value of revolving discharge.

L. J. Wing Mfg. Co.
140 Vreeland Mills Road, Linden, N. J.

Please send me a copy of your Bulletin HR-6. Wing Revolving Unit Heaters.

Name .....
Firm .....
Address .....
City ..... Zone ..... State .....

WEBSTER
KINETIC* BURNER

For Low Pressure Gas

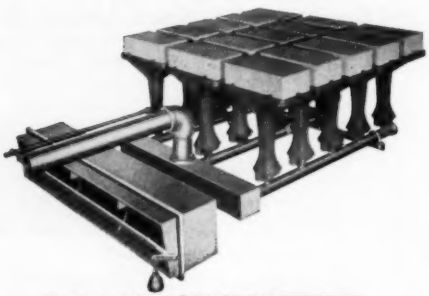
The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

●

WEBSTER
SERIES F 600 BURNER

For Low Pressure Gas



Designed for LOW GAS PRESSURE
INTERCHANGEABLE PORTS
RADIANT fire brick top
NO COMBUSTION CHAMBER required
WILL NOT VIBRATE
LOW draft loss
ANY SHAPE and Size
INTEGRALLY MOUNTED pilots

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

NOW is the time to consider

SNOW MELTING

Systems around Buildings and Grounds

Better send at once for our SNOW MELTING MANUAL. Here are design data based on a study of—and others' actual experience with over 100 snow melting systems of all kinds for

- LOADING PLATFORMS and DOCKS
- SIDEWALKS • ROADS • DRIVEWAYS
- MARQUEES • PARKING AREAS
- RUNWAYS • RAILWAY SWITCHES

and other applications which HAVE proved that this modern method of snow removal

Costs No More Than Other Methods

—and because snow melting by pipe coils has other distinct advantages, such as dirt-free sidewalks and entrances, and the complete elimination of ice surfaces, the demand for this method of snow removal is swiftly growing.

Complete information on the correct design, installation and operation of snow melting systems is offered in the new SNOW MELTING MANUAL, a reprint of articles originally published in HEATING, PIPING & AIR CONDITIONING.

$1.00 will bring you this SNOW MELTING MANUAL . . . a valuable addition to your file on business opportunities.

Heating, Piping & Air Conditioning

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Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial large building heating, piping and air conditioning products.

If you would like your name listed on our records for inquiries we may receive for your territory, we invite you to write us. There is no charge in connection with this service.

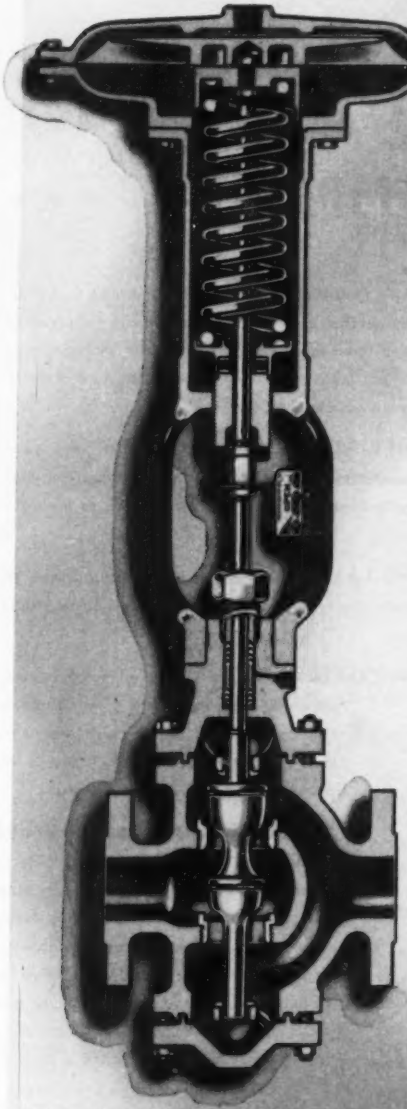
HEATING, PIPING & AIR CONDITIONING

6 N. Michigan Ave. Chicago 2, Ill.

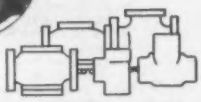
Exclusive features of design plus quality controlled materials and workmanship are the reasons

FISHER®

Diaphragm Motor Valves are Universally Preferred



FISHER ALLOY SPRINGS are tested for load tolerances of plus or minus 2½%.



VARIETY OF BODY TYPES and materials—iron, steel, bronze, alloys, single and double seated, angle and globe.

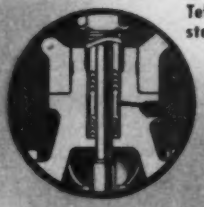
2 YOKE MOUNTING PADS for valve positioner and other auxiliary equipment.

WIDE CHOICE OF INNER VALVES to provide desired flow characteristics.

QUALITY CONTROLLED materials and workmanship.

WALL SECTIONS conform with ASA fittings code.

Fisher offers the most versatile and complete line of Diaphragm Motor Valves—manufactured to handle pressure conditions up to 6,000 pounds. Available in metals for highly corrosive service and alloys for high temperature work. They are built for your specific requirements.



VERSATILE! ECONOMICAL!

Teflon V-Ring Packing, requiring no lubrication, is standard on all Fisher Diaphragm Motor Valves

Dual Teflon packing also available. 2 sets of packing separated with bleed area where purge zone is desired. Positively prevents outbound leakage—or inbound leakage under vacuum service. For dangerous toxic, corrosive, etc. applications.

FISHER

FISHER GOVERNOR COMPANY • Marshalltown, Iowa

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE CONTROL

..FACTS ABOUT CORK for Low Temperature . . .

CORK is one of the most useful materials known to man. Not only has it been in service longer than history can record, but its use has greatly increased with the need for modern industrial efficiency and economy. The reason for this is that Cork is completely unique in its physical structure and qualities. There's *nothing* like Cork!

1. Cork is MONEY-SAVING! Millions of dead-air cells in every square inch of Cork insulation cause it to serve as a most efficient *natural* barrier to heat flow. By its use, refrigeration is conserved to the most practical limits.

2. Cork is LONG-LASTING! Cork has high structural strength and is a most durable material. It continues to serve for many years at highest efficiency.

3. Cork is TIME-TESTED! The use of Cork insulation has kept pace with the development of refrigeration and cold storage. Its wide acceptance in these "heavy-duty" industries is due to its proved record for more than 40 years.

Write for FREE copy of Mundet Insulation Manual

4. Through more than 80 years as Cork specialists, we are able to preserve Cork's natural advantages in Mundet insulating products. Mundet engineers give you responsible assistance in building or expanding low temperature facilities. Let us help you secure low operating cost and maximum service. Mundet Cork Corporation, Insulation Division, 7101 Tonnelle Avenue, North Bergen, N. J.

Mundet district offices are conveniently located coast-to-coast.

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Write us for name of our nearest representative if there is no Mundet office in your city.

MUNDET CORKBOARD
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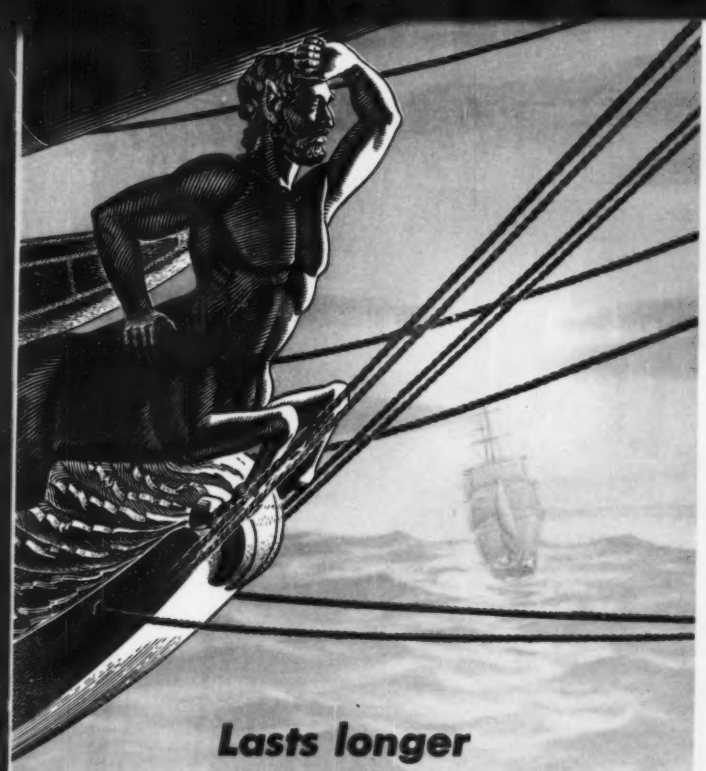
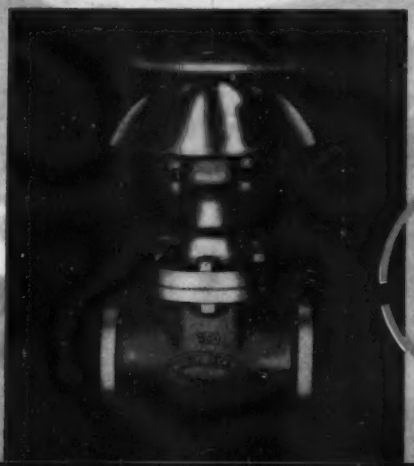
CONSERVES LOW TEMPERATURE



Lasts longer in corrosive service

Like all ALOYCO valves, this acid-shield gate valve is especially engineered for severe corrosive service. Its dependable performance results from extensive metallurgical research and production of high alloy valves exclusively.

ALOYCO No. 111-A acid-shield gate valve is made in a wide range of analyses to specification and regularly stocked in popular alloys.



SUCCESS STORIES FROM ALOYCO'S CORROSION CLINIC

THE CORROSIVE: Water contaminated with 20% acetic acid.

THE APPLICATION: Step in manufacture of aspirin powder for The Bayer Company, division of Sterling Drug, Inc.

THE VALVE: ALOYCO No. 111-A Gate valves.

THE RESULTS: Corrosion and subsequent leakage required replacement of cast iron valves. Sixteen ALOYCO gate valves have been in service two and a half years completely free of maintenance.

THE BACKGROUND: Contamination prevention is only one reason why ALOYCO valves are selected for such a wide variety of applications in the chemical industry.

The *Aloyco Corrosion Clinic* works exclusively in corrosion-resistant alloys. Your problem—whether it is contamination, discoloration, temperature extremes, corrosion, or cost—can be solved by the Clinic.

If you must guard against corrosion, call on the *Aloyco Corrosion Clinic*, for the right alloy, the right valve.

The Bayer Company is so completely satisfied with the performance of ALOYCO valves in this installation they are buying more for all parts of the plant.

ALLOY STEEL PRODUCTS CO., INC.
1322 West Elizabeth Avenue, Linden, N. J.

Longer Lasting
ALOYCO VALVES
1st in Corrosive Service

An Outstanding Record of Acceptance!

LESLIE Floatless Level Control installation on five 85-90000 kw generators, maintaining the hotwell level ±1" by controlling 6" valve in condensate pump discharge — in service 12 months — led to 16 more installations for same company.

The above is typical of the fast growing acceptance of this rugged and accurate level control.

ADVANTAGES

- EASY TO INSTALL
- ACCURATE REGULATION (±1" Water Column)
- NO FLOATS, STUFFING BOXES, ETC.
- MULTI-MEDIUM ACTUATED
- DIAPHRAGM PRESSURE ELEMENT
- ACTION REVERSIBLE

Applications: On open and pressurized vessels, including boilers, tanks, evaporators, heaters, standpipes, etc.

PRINTED IN U.S.A.

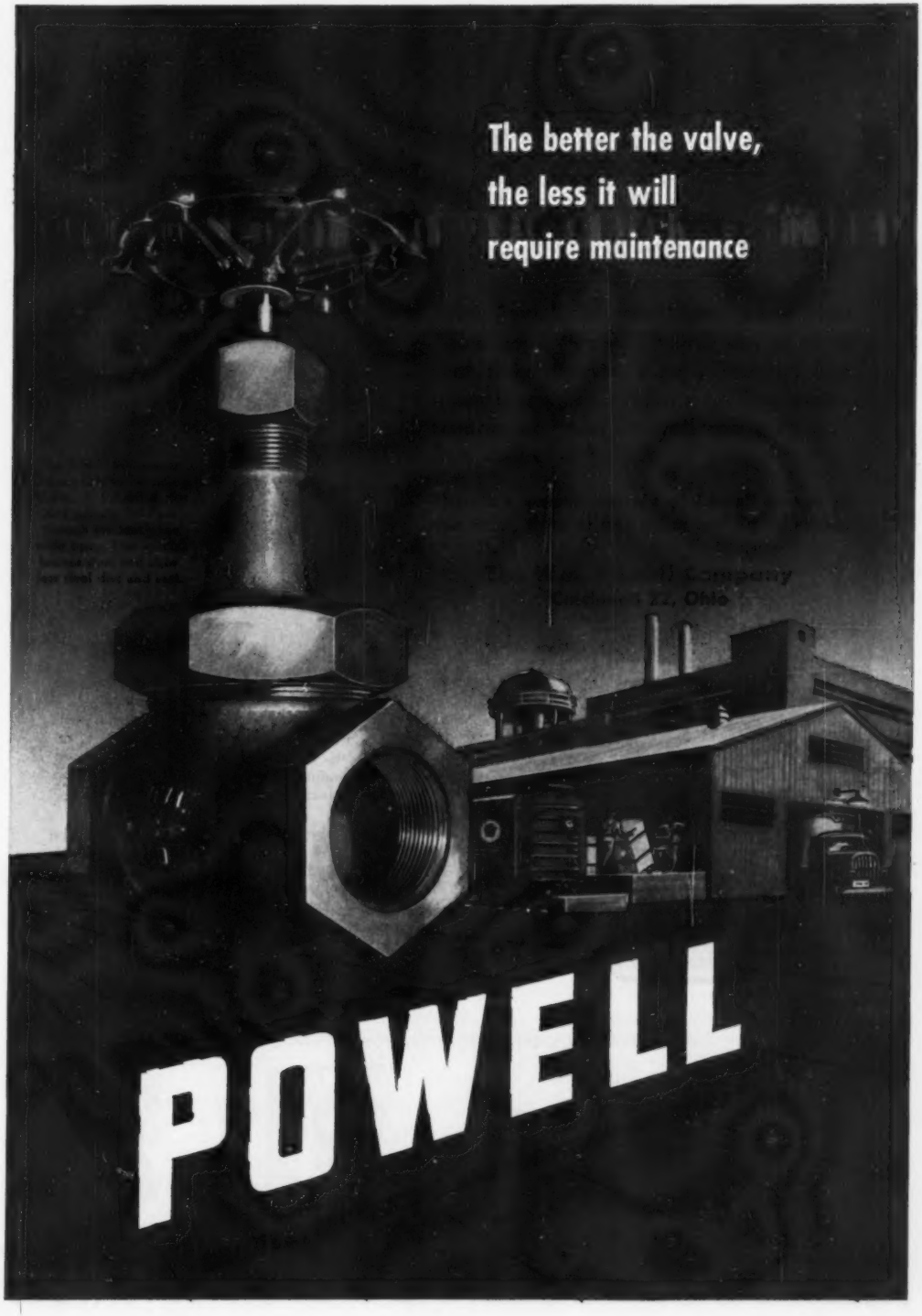
SEND for illustrated Bulletin

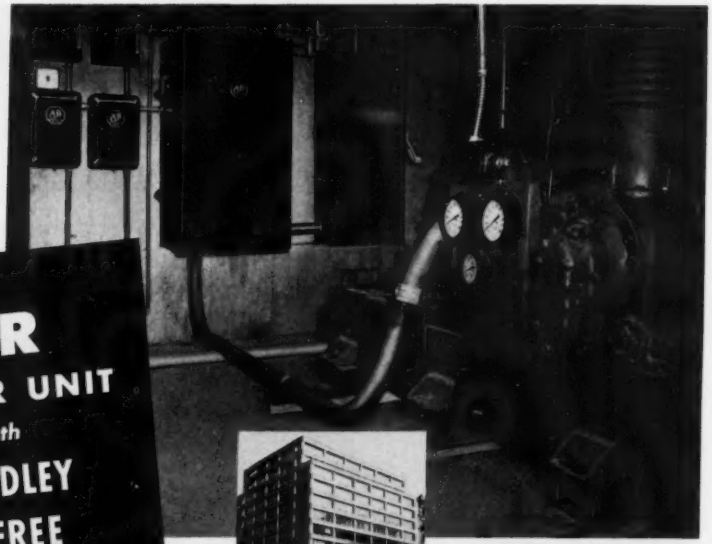
Look for LESLIE Regulators under "Valves" or "Regulators" in your Classified Telephone Directory in leading industrial cities where LESLIE factory-trained engineers are located.

LESLIE CO., 265 Grant Avenue, Lyndhurst, New Jersey

1827

PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS • FLOATLESS LEVEL CONTROLS
PUMP GOVERNORS • TEMPERATURE REGULATORS
SELF CLEANING STRAINERS • AIR HORNS • STEAM WHISTLES


The better the valve,
the less it will
require maintenance
POWELL



BAKER
COMPRESSOR UNIT
equipped with
ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

Kass Realty Company Building in Washington, D. C., is completely air conditioned, using Baker compressors equipped with reliable Allen-Bradley Bulletin 709 Automatic Starters.

A-B Quality

Why are Allen-Bradley automatic starters so popular for refrigeration and air-conditioning service? . . . Because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing.

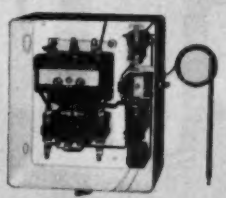
Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co.
1335 S. First St., Milwaukee 4, Wis.

ALLEN-BRADLEY SPECIAL REFRIGERATION CONTROL UNITS

Allen-Bradley offers a wide line of air-conditioning and refrigeration controls — pressure and temperature controls, manual and automatic starters, and special refrigeration control units. The two units at the right show Allen-Bradley special refrigeration control units consisting of solenoid starter, high pressure cutout, thermostat, and manual starting switch. You can install A-B controls and forget them.



Bulletin 709 Size 2 Starter Unit

Bulletin 709 Size 1 Starter Unit

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

Here's another reason why the 'Specs' call for "WELDOLETS"

LET'S COMPARE THE PLUS FEATURES OF WELDOLETS AGAINST REINFORCING RINGS OR PADS

1. The WeldOlet is a Welding Fitting rather than a hand-made reinforcement of a hand-made joint. It is both a mechanical and a pressure member.

2. The self-aligning, shaped and beveled WeldOlet is equally adaptable for shop or field fabrication. Its employment eliminates the need for additional reinforcement.
3. Production economy is realized by employment of WeldOlet construction which speeds up installation time in both shop and field fabrication. Only two welds are required to install WeldOlets.
4. The WeldOlet type of construction inherently provides sufficient reinforcement in accordance with Code requirements to meet or surpass the maximum services of whatever weight pipe is used. To facilitate determination of where it is necessary to reinforce or to use a WeldOlet, the new Bonney catalog W-3 features time-saving data on this subject.
5. Dimensional advantages of WeldOlets allow closer manifolding and cross combinations and provide improved flow conditions.

1. Precious pipe is wasted in making reinforcing rings or pads.

2. Reinforcing rings can be cumbersome to handle and clumsy to fit in both shop and field fabrication.
3. Excessive welding is necessary to complete branch reinforcing requirements according to Code provisions when rings or pads are used. Three separate welds are required. This slows down piece production time in both shop and field fabrication.
4. Lengthy calculations are necessary to determine the amount of reinforcing required when designing for ring or pad reinforcement.

The Bonney Catalog No. W-3 will show you why WeldOlet Welding Fittings offer the quickest, safest and most economical method of establishing and maintaining 100% pipe strength at branch connections in accordance with Code provisions. Write for your free copy.

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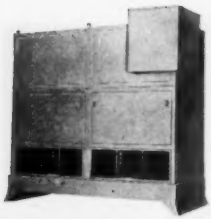
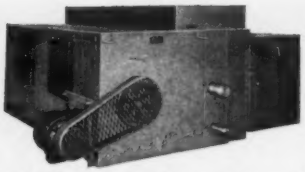


COOLING TOWERS—Air Conditioning, Refrigeration, or Industrial Applications. Outdoor-Indoor. 5 to 75 Tons. Catalog 494.



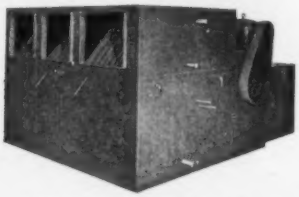
HEATING AND VENTILATING UNITS—Air Volumes 300 to 28,800 CFM. Catalog No. HV-1.

KENNARD *Engineered*

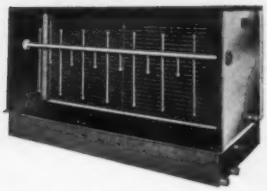
HEAT TRANSFER PRODUCTS

Architects, Consulting Engineers and Contractors have long known the quality performance of Kennard Heat Transfer Products. Now, more than ever, Kennard is being specified because of the many features frequently found only in Kennard products.

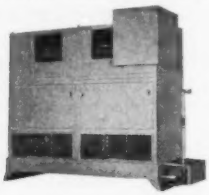
Specify Kennard on your next job.



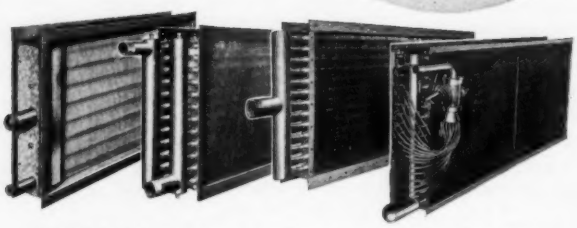
MULTI-ZONE UNITS—Sizes up to 36 sq. ft. Cooling Coil Face Area. Catalog MZ-1.



SPRAYED COIL DEHUMIDIFIERS—56 Sizes. Coil Face Areas to 81 sq. ft. Catalog No. SC-1.



EVAPORATIVE CONDENSERS—Indoor-Outdoor. 7½ to 75 Tons. Catalog No. 491.



FINNED COILS—Direct Expansion Coils, Water Coils, Steam Distributing Tube Coils, Standard Steam Coils. Sizes up to 48" wide x 120" long. Catalog No. 47A.

AIR CONDITIONING BLOWER UNITS—13 Sizes. 300 to 21,600 CFM. Horizontal or Vertical. Catalog No. 486.

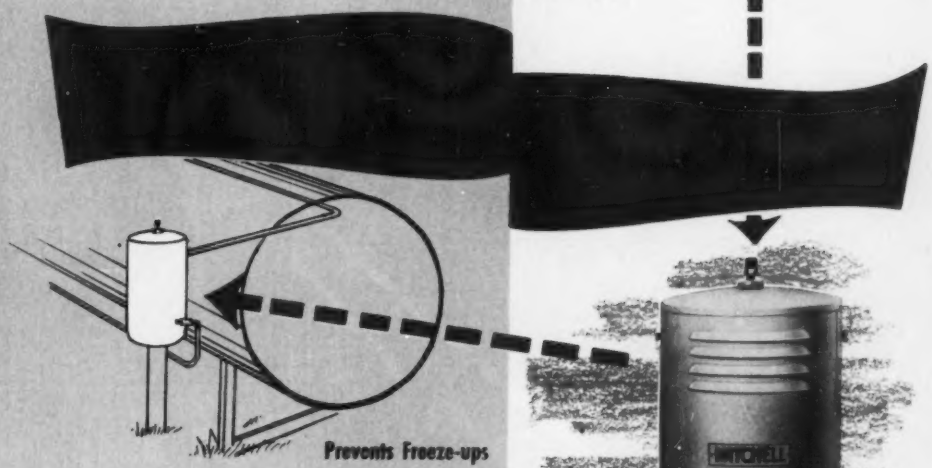
Write for name of nearest representative and catalogs needed.

KENNARD CORPORATION • 1817 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

If you're designing a system for Butane-Propane..

to assure a steady supply of gas of constant heating value and uniform pressure . . .

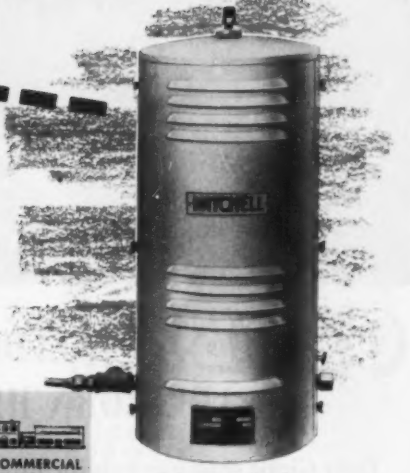
SPECIFY A



Prevents Freeze-ups due to temporary overloads or large withdrawals!

MITCHELL vaporizers are designed to provide a constantly controlled, precisely regulated supply of gas with butane-propane systems. By means of patented Automatic Selective Control, a MITCHELL unit will supply gas in exact response to demand thereby preventing freeze-ups due to temporary overloads or large withdrawals.

If your design calls for a butane-propane system, specify a MITCHELL Vaporizer to complete the job. For full details on special installations, contact our Engineering Department.



Underwriters Listed!

Model 30 MITCHELL Vaporizer

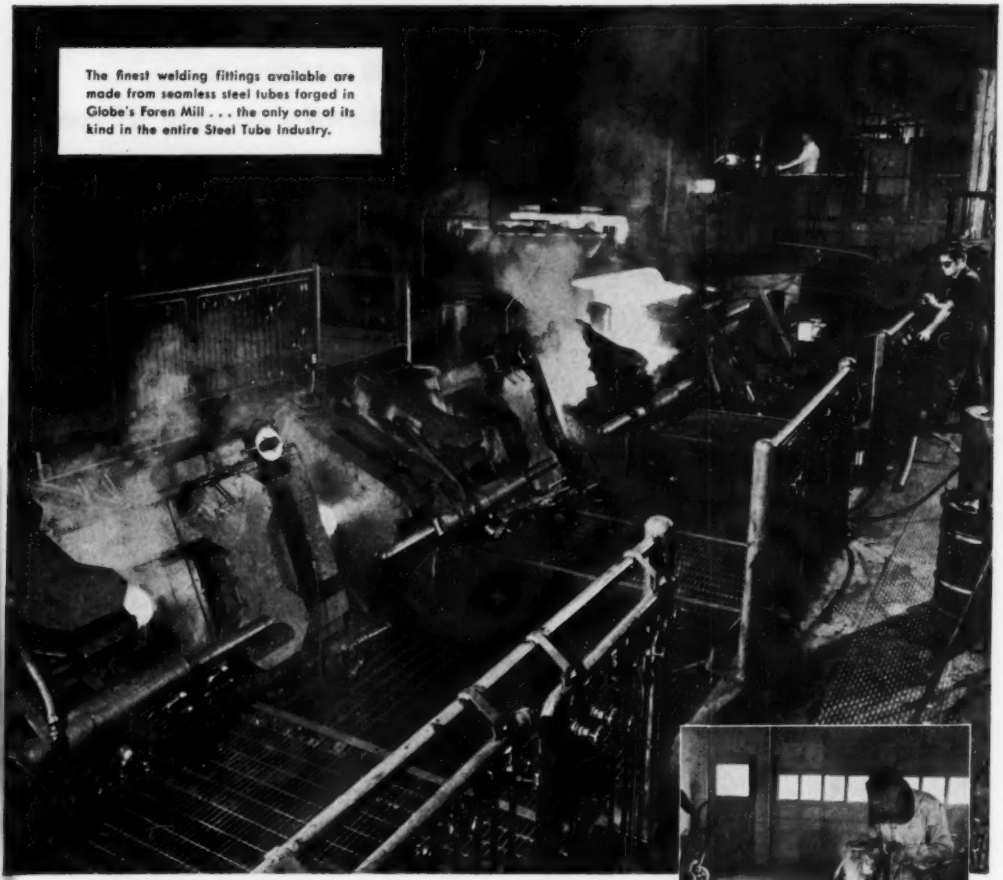
Capacity—30 gallons per hour (rated input—30,000 BTU per hour). Other models from 2 to 280 gallons per hour.

WRITE FOR FREE BOOKLET

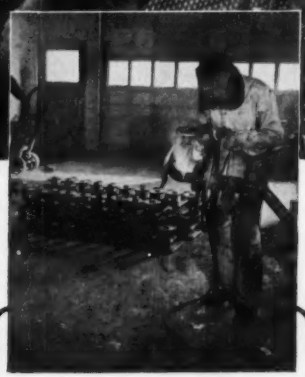
Tells how the MITCHELL Vaporizer is installed . . . how it's used . . . address JOHN E. MITCHELL COMPANY, 3800 Commerce St., DALLAS, TEXAS.

JOHN E. MITCHELL COMPANY

Manufacturers of Fine Machinery for more than Forty-Five Years
DALLAS, TEXAS


The finest welding fittings available are made from seamless steel tubes forged in Globe's Foren Mill . . . the only one of its kind in the entire Steel Tube Industry.

GLOBE WELDING FITTINGS ARE BORN HERE



Only Globe seamless welding fittings are precision processed from *billet* . . . to *tube* . . . to *fitting*

Globe precision-process manufacture begins with the billet — continues through the making of the seamless steel tube — and extends through to the production of the finished fittings.

The exacting controls in Globe's precision process — plus specialized research, testing and engineering insure uniform high-quality and close tolerances. Be sure of dependable fittings . . . always specify Globe.

For complete information on the finest welding fittings available anywhere, send for the Globe Welding Fittings Catalog.

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • Philadelphia • St. Louis
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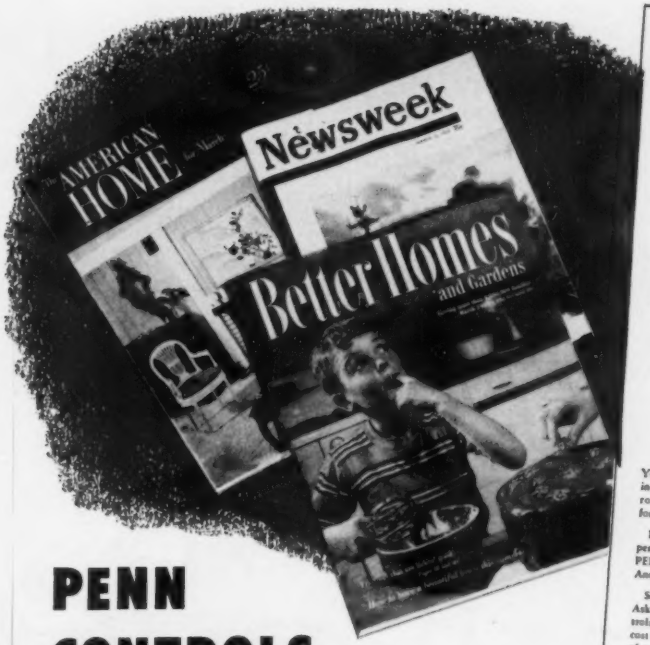
Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.



suffering from HOT-n-COLD LIVING?
then insist on the
PENN
heat-anticipating room thermostat
You've experienced it . . . too hot one instant, cold the next . . . all because room temperatures swing back and forth from low to high.
But, now you can hold room temperatures within 1° with the amazing PENN heat-anticipating thermostat. And that's real heating comfort!
So, get automatic heating at its best. Ask your dealer to install PENN Controls on your heating system . . . they cost no more. For even greater comfort of automatic day-night control, also get PENN Tem-Clock.
Penn Controls, Inc. Goshen, Indiana
ENGINEERED COMFORT
PENN
AUTOMATIC CONTROLS
Selected by leading manufacturers for over 30 years
FOR HEATING, REFRIGERATION, AIR CONDITIONING PUMPS, AIR COMPRESSORS, ENGINES, GAS APPLIANCES

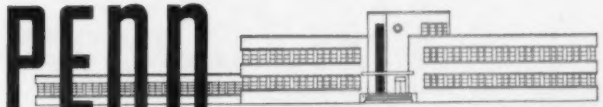
PENN CONTROLS

are nationally advertised to help you sell more!

Your heating prospects will see and read PENN's appealing ads thoughout the year in the above national magazines. These ads will inform homeowners how to eliminate HOT-n-COLD LIVING by calling *you . . . their heating dealer!*

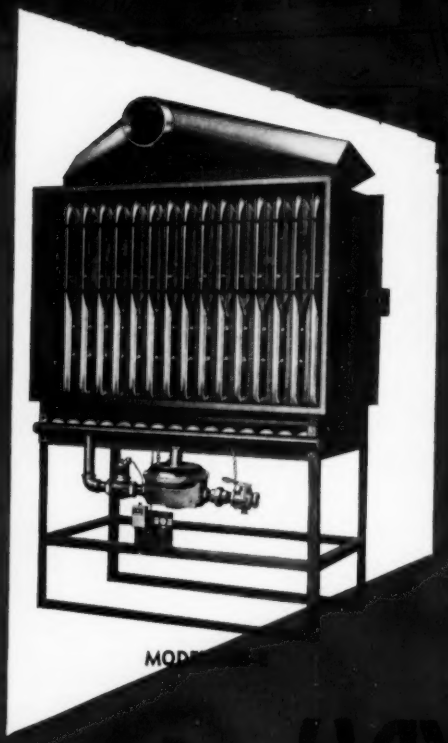
And you'll sell more by showing prospects how automatic heat controlled by the PENN heat-anticipating thermostat is their best buy for unsurpassed heating comfort. So . . . recommend and install PENN heating controls. **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ontario.

Watch for the PENN advertising in the May, June, September, October and November issues of the above national magazines.



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES



MODEL

HAYES DUCT FURNACE

for choosing **kno·draft** adjustable air diffusers

Office space and manufacturing areas in this new asbestos dryer felt plant posed separate problems in air conditioning. In the manufacturing section, the vital factor in diffusion was the *even distribution* of the thoroughly conditioned air. Kno-Draft *Adjustable* Air Diffusers got the call because of their demonstrated efficiency in similar critical installations.

In offices and other employee quarters, beauty as well as efficiency had to be considered. Here again, Kno-Draft *Adjustable* Air Diffusers were selected. In addition to their unobtrusive harmony with any surroundings—from severely plain work areas to paneled directors' rooms — they assure the comfort of *draftless* air distribution.

Another big reason for choosing Kno-Draft *Adjustable* Air Diffusers for every job is their adjustability *after* installation. This means exactly the right balance of temperature and air distribution throughout the area for user comfort . . . and saves engineer and installer a vast amount of preliminary figuring. There are types and sizes of Kno-Draft *Adjustable* Air Diffusers to meet all requirements.

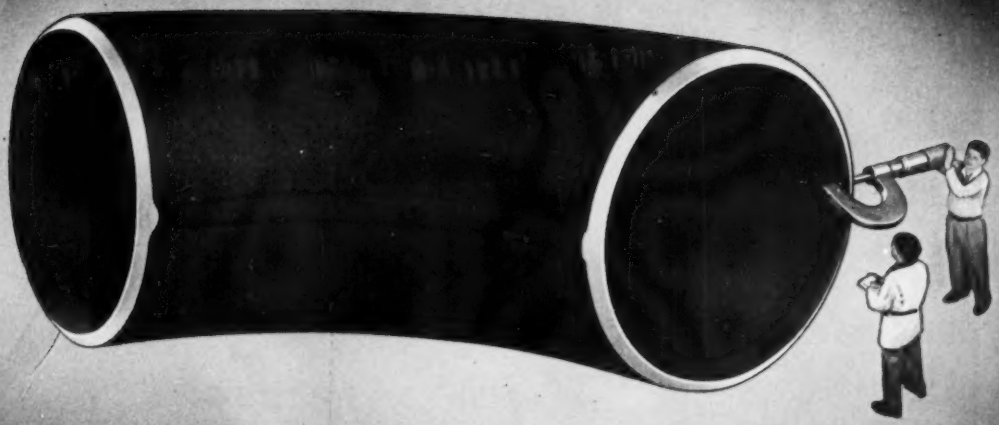
NEW EDITION! KNO-DRAFT DATA BOOK now in new 32-page format. Complete up-to-the-minute engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. Bring your files up to date. Mail coupon today.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

W.B. CONNOR ENGINEERING CORP.
Danbury, Connecticut
Air Diffusion • Air Purification • Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.
Dept. G-52, Danbury, Connecticut
Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

Name .....
Position .....
Company .....
Street .....
City ..... **Zone** ..... **State** .....



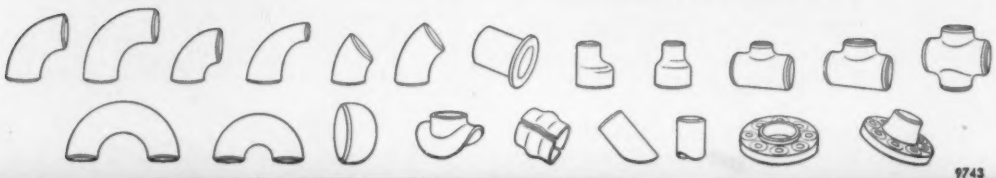
REGARDLESS OF SIZE . . . they must have *Dimensional Accuracy*

This photographic fantasy is simply to emphasize the exceptional dimensional accuracy and uniformity of Midwest Welding Fittings that saves time in welding and reduces piping costs.

MIDWEST
PIPING & SUPPLY CO., Inc.

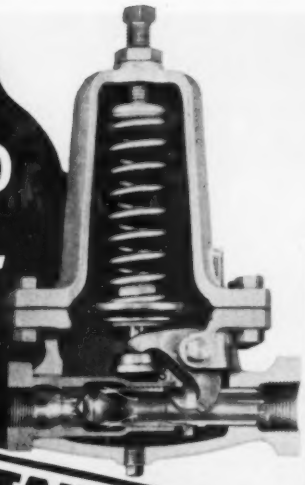
Main Office: 50 Church Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Boston
Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—1213 Capital Ave.
Tulsa 3—324 Wright Bldg. • Boston 27—426 First St.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS



9743

PUT IT ON THE LINE AND *forget it*



CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000

Streamlined
FOR SMOOTH EVEN FLOW
of Steam, Water, Air, Oil, Etc.

● That is the Streamline story in a nutshell. The way it works is the answer — from inlet to outlet the fluid flows through this valve in a straight line — a streamline. There is no detour around a dividing wall — the direction of the flow is not changed at right angles because of a seat wall AND the flow is not broken up by valve stems, springs, or other parts. Forget it once it's installed like others do. PROOF: "We have a large number of buildings scattered over about 100 acres of land. Just where we installed these Streamlined Valves I dont know. But I do know that I haven't seen or heard of them since they were installed."—Case No. 343. PROOF: "We installed four or five of your Streamlined Regulators. The last I heard of them they were holding pressure the same as when we first installed them. And as far as I know no one has ever touched them." —Case No. 345.

Bulletin 1000 will give you full details.

YOU GET MAXIMUM CAPACITY WHEN IT IS NEEDED MOST

TROUBLE-FREE SERVICE	CONSTANT DELIVERY PRESSURE
SMOOTH OPERATION	PRACTICALLY ZERO IN MAINTENANCE COST
TIGHT CLOSURE	SPEEDIER PRODUCTION RESULTS
NO SPOILAGE	COST-SAVING OPERATION

ACCURATE PRESSURE CONTROL AT ALL TIMES

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

●

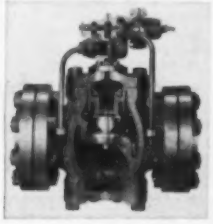
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

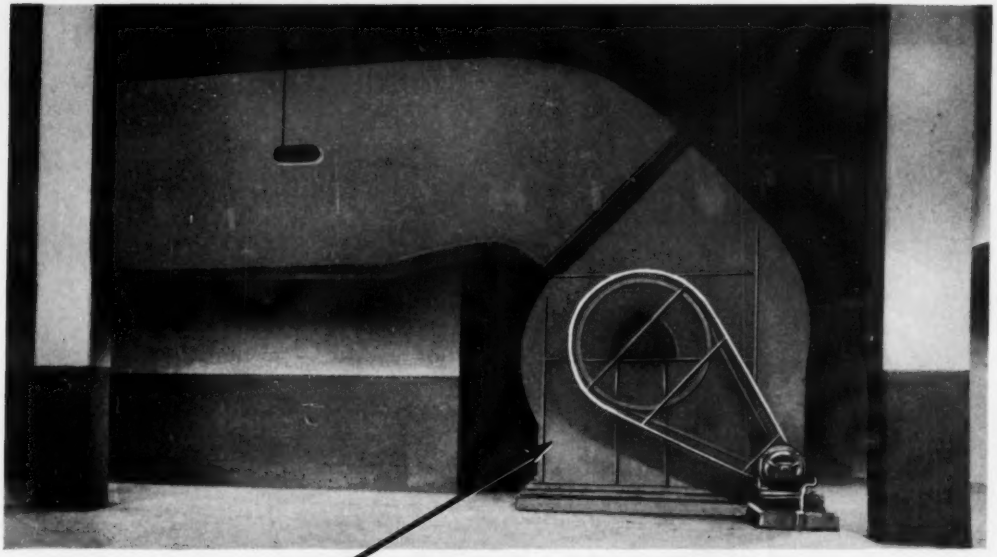
●

Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.



The ♥ of Your System—

It's a supply fan, of course. Yet, there's a surprisingly close analogy between mechanical ventilation and blood circulation. Supply ducts are arteries, branches are capillaries, spaces are cells, returns are veins, — we could draw out this parallel, but you'll get the point without further elaboration.

Some analogies may be misleading. But in this case, we're sure you'll agree that whether circulating air or blood, the system functions to best advantage when equipped with a sound heart. If the heart fails, circulation stops, with fatal results.

The heart with which you're born is not one of your personal choice, but you *do* have the choice of one for your ventilating or conditioning system. Certainly you'll want to make the best of this opportunity.

Don't take chances on a weak heart. Choose wisely! Choose Bayley! And finally, — for even longer life, take care of that heart. It's the most vital component in your system.

— performs better, — longer,

if it's Bayley

AIR HANDLING EQUIPMENT

BAYLEY BLOWER COMPANY

6600 W. BURNHAM ST. MILWAUKEE 14, WIS., U. S. A.

a LIFESAVER because it's a PIPE-SAVER

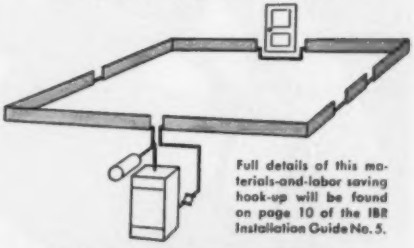
RADIANT BASEBOARDS...

Save pipe? You bet! A good fat 40%. Why? Because when you hook up Burnham BASE-RAY* Radiant Baseboard in the Series Loop System (shown at right) it actually becomes part of the main. Just a glance at the diagram shows how it saves scarce pipe. And better still this foolproof system saves you 49% in fittings and 54% in installation labor costs. In these days that's to the good and remember you're giving your customers a modern radiant heating system to boot.

*Reg. U.S. Pat. Off.

Also you can give your customers "oceans of domestic hot water," year 'round with a famous Burnham PACEMAKER or YELLO-JACKET Boiler. Each has built-in copper water heater . . . tankless or storage type.

with the
SERIES LOOP SYSTEM



Full details of this materials-and-labor saving hook-up will be found on page 10 of the IBR Installation Guide No. 5.

Ideal for ranch type and basementless houses, the Series Loop System can be used with comparable results in the 2-story house with basement.

BASE-RAY WEARS LIKE IRON . . . FOR IT IS MADE OF IRON

Burnham Corporation

FIRST IN THE MANUFACTURE OF BASEBOARD HEATING

BOILER DIVISION . . . IRVINGTON, NEW YORK

BURNHAM CORPORATION, Irvington, N. Y. Dept. HP552

Please send me BASE-RAY Literature:

☐ New 6 page BASE-RAY folder ☐ BASE-RAY Ratings and Installation Guide

Name .....

Address .....

City ..... State .....

A FAIR OFFER
If you will put a Jenkins Valve, recommended for your particular service, on the worst place you can find — where you cannot keep other valves tight — and if it is not perfectly tight or it does not hold steam, oil, acids, water or other fluids longer than any other valve, you may return it and your money will be refunded.
Jenkins Bros
A FAIR OFFER THAT HAS BEEN IN EFFECT SINCE 1869
JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK
Jenkins Bros

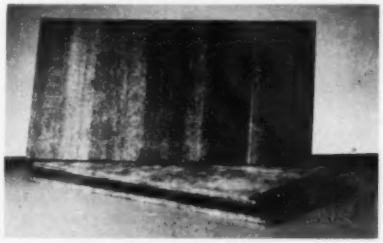
This famous "Fair Offer" has been published at frequent intervals for the past 83 years. It can be repeated, again and again, only because all Jenkins Valves measure up to its sincere pledge of exceptional dependability.

Despite their *extra value,* proved by countless economy records in every type of service, *you pay no more* for Jenkins Valves. Jenkins Bros., 100 Park Ave., New York 17.

EQUIPMENT DEVELOPMENTS...

Duct Insulation Designed to Prevent Condensation

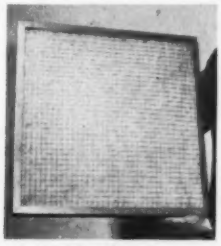
HPAC 1 — "Vapor-Seal" duct insulation designed to prevent condensation on air conditioning ducts which carry cool air in warm, humid areas—Owens-Corning Fiberglas Corp., 1911 Nicholas Bldg., Toledo 1. The insulation consists of fine fibers of glass, bonded together by a stable resin into a rigid, rectangular insulating board. One surface and both ends are covered with asphalt and kraft paper, forming an integral vapor barrier. The material is furnished in 24 x 48 in panels, and in thicknesses of ¾, 1, 1½ and 2 in. It may be applied by the same conventional methods used for semi-rigid insulation. If screw-and-cap or metal clip methods are used, the vapor barrier is punctured, and sealing of the holes is necessary. All holes must be sealed with a cut-back asphalt mastic. To prevent asphalt from bleeding through and staining finishes on exposed ducts, metal lath and corner beading should be attached to the insulation and a plaster finish applied. For sealing joints in insulation after application, a heavy trowel coat of a vapor barrier mastic should be worked into the joint and carried out 2 in. on either side. The insulation may be applied in a single operation, the manufacturer states.



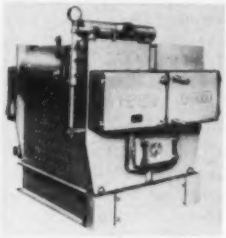
Self-Charging Electrostatic Air Cleaner

HPAC 2—"Pliotron" permanent self-charging electrostatic air cleaner for heating, air conditioning or ventilating — Goodyear Tire and Rubber Co., 1144 E. Market St., Akron. The shredded filter material contains an electrostatic charge processed into it, and additional electrostatic charge builds up as air passes through the filter, according to the manufacturer, which attracts dust particles.

When the filter becomes dirt clogged, it is lifted out, washed in cold water, and replaced, the frame being slipped into the filter holders of the air circulation system.



Air Cleaner



Boiler

Steel Heating Boiler

HPAC 3**—"LW" series divided low water line steel heating boiler for standard working pressures of 15 lb steam and 30 lb water (also available for water working pressures up to 100 lb)—Lycoming-Spencer Div., Avco Mfg. Corp., Williamsport Pa. It has an overall height and water line 25 percent less than conventional compact-type firebox boilers, and allows very low horizontal header connection where head room is at a premium, the manufacturer states. The divided design (two watertight

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1952 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [5-52]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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101	102	103	104	105		107	108	109	110	111	112	113	114	115
116	117	118	119	120	121	122	123	124	125	126	127			130
131	132	133	134	135	136	137	138	139	140	141	142	143	144	

Name _____ Title _____

Company _____

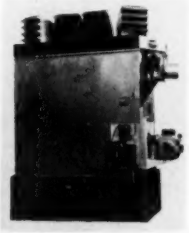
Address _____

City _____ Zone _____ State _____

sections) is intended to afford entry through narrow openings, and to require no welding on the job. The outlet header is adaptable to either front or rear take-off. The boiler has an extra high firebox and combustion chamber above the water leg, designed for quiet combustion of all types of fuels. It is adaptable to either front, rear or side installation of mechanically fired equipment, and may be used as a hand fired boiler for either bituminous or anthracite coal.

Space Heater for Large Industrial Applications

HPAC 4—"Thermobloc" space heater, designed to produce 2 million Btu per hr, for use in heating areas of from 16,000 to 24,00 sq ft—Thermobloc Div., The Prat-Daniel Corp., 2 Meadow St., South Norwalk, Conn. This model has twin heat exchangers arranged in the form of a "V," a design resulting in maximum scrubbing of the heating surfaces by the air passing through, according to the manufacturer. For discharge, diffusers give pinpoint control of air throw. These outlets may be placed in any position, and can be rotated a full 360 deg. Single ducts may be run from any outlet to adjoining rooms if necessary. The unit may also be used as a central heating plant, a plenum chamber being supplied in place of the four diffusers. Normal air output is 22,000 cfm, and air intake velocity is 440 fpm. The fan is powered by a 10 hp motor, and the unit can use either light fuel oil, with a pressure atomizing gun type burner, heavy oil, with a horizontal rotary cup burner, or gas, with a power burner. It may also be equipped with a combination burner for conversion of gas to oil or oil to gas.



Heater

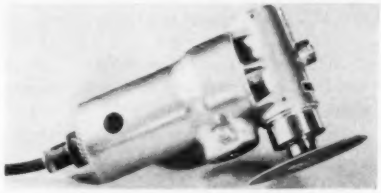
Conditioner

Self-Contained Air Conditioners with Integral Evaporative Condensers

HPAC 5—New line of medium tonnage, self-contained air conditioners, with integral evaporative condensers — The Trane Co., La Crosse, Wis. Designed to meet stringent municipal regulations on water consumption and disposal, the units will be produced in 15 and 20 ton capacities. This range serves a variety of medium sized offices, stores, etc. Units are designed to meet year round requirements, delivering conditioned air through a duct system. They are shipped completely wired, piped, dehydrated, charged and tested for operating conditions specified in each job. Electrical, water piping, and air distribution connections are then required for operation. Units incorporate a multi-step reciprocating compressor which steps down power consumption automatically when reduced cooling is needed. The evaporative condenser's fan motor and pump are mounted in the conditioner compressor section. Moisture condensed from the atmosphere by the conditioner's cooling coil is added to the spray water in the condenser, cutting overall water consumption as much as 98 percent on humid days, the manufacturer states.

Disk Grinder

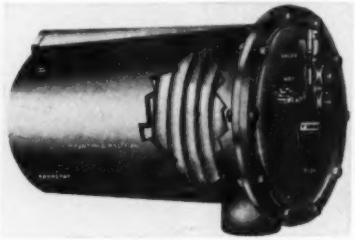
HPAC 6**—"Diskette" lightweight, high-speed, disk grinder, designed for one hand operation, with a speed of approximately 8000 rpm—Balmar Corp., Woodberry, Baltimore 11. The instrument grinds, sharpens, and shapes all metals, as well as woods, plastics and ceramics. Special attachments equip it for hole burring, rotary filing and cutting, solder cutting, and other operations. The tool



weighs 4½ lb, and is 9 in. long, with a 2¾ in. diameter. The motor operates on 110 volt, a-c or d-c current. The tool is furnished with three composition disks, as well as a screw driver and a 3/16 in. pin wrench. The motor is air cooled by a fan in the housing, and a dust filter protects it from dust and grit. Other attachments are available separately. Typical applications include welding, tool and die work, foundry and repair shop work, etc.

Tankless Water Heater with Tempering Valve

HPAC 7*—Tankless water heater with built-in manual tempering valve — The Alstrom Corp., 790 E. 176th St., New York 60. Built into the removable cast-bronze convex head of the water heater, the valve is easily adjusted for summer-winter control of hot water temperature, and does not create a pressure un-balance, the manufacturer states. It is preset at the factory for normal operating conditions, but can be adjusted in special cases where the bypass must be regulated. The "T" and "Uni-Heat" tankless series



have low pressure drop because the all-helically-wound coil has continuous smooth curvature and no soldered joints. According to the manufacturer, the ⅝ in. copper tubing produces 20 percent greater heating surface and 80 percent less liming and clogging; the cast-iron shell is designed for balanced flow over the coil, has self-flushing sludge chamber, aquastat opening and an octagonal inlet boss. A ⅛ in. vent is intended to assure freedom from air binding. Units are hydrostatically tested and have hot water capacities of 4, 6 and 8 gpm.

HOT JOBS call for COOL HELP!

Pouring liquid steel into ingot moulds at a temperature of 2800° F. is a hot job that demands skill and constant attention. When workmen are exposed to such intense heat, thermotic fatigue can be a real problem.

At Colorado Fuel and Iron Corporation's mill in Pueblo, Colorado, they solved the problem by mounting a DeBothezat "Hy-V" Air Jet on the cab of the crane which handles the ladle, so that the fan unit travels right with the men as they work. "Hy-V" Air Jets project a concentrated stream of fresh air as far as 35 feet, without the use of ducts, to keep workers comfortably cool, alert and efficient.

DeBOTHEZAT "HY-V" AIR JET is a 14-blade axial-flow pressure fan in a nozzle-shaped housing. It can be furnished with a bracket for wall installation or it can be mounted on a portable wheeled stand. Both types are available with fan wheels from 18" to 30" in diameter, with capacities up to 12,000 CFM.

Ask your DeBothezat Fans representative or write the factory today for a bulletin on "Hy-V" Air Jets. Address Dept. HP552.

Certified Ratings

DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

Timer Switch for Air Conditioners

HPAC 8**—Portable, plug-in, automatic timer switch for air conditioners up to and including ¾ hp capacity — Time 'Trol Co. (distributor), 135 Liberty St., New York 6. Timed by Tork and motored by Telechron, it has a 24 hour dial, with six hours each for morning, afternoon, evening and night. There are two sets of "on" and "off" arms, allowing for two settings daily. The device automatically turns room air conditioners on and off at any desired time. One model has an "omit wheel," which allows the setting to remain off any day or combination of days, the conditioner being automatically turned on again on the day when operation is desired. Unless the setting is changed it will continue to operate each week on a set schedule. No installation is required. The device is completely portable, and the switching mechanism has been used for nearly 30 years in the electrical control field, according to the distributor. The instrument was developed by Walter H. Steiner.

Timer

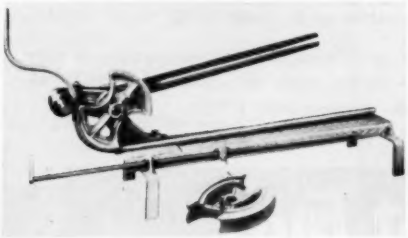
Valve

All Purpose Gate Valve

HPAC 9—No. 90 bronze solder end gate valves, for hot and cold water lines or low pressure steam, having working pressures of 125 lb steam, and 200 lb (non-shock) cold water, oil, and gas — R-P & C Valve Div., American Chain & Cable Co., Inc., Reading, Pa. Valves will not distort, nor will the seat warp, under soldering temperatures, the manufacturer states. They are for use with K, L, and M copper tubing.

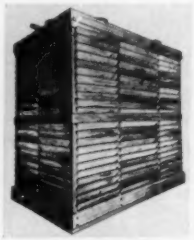
Pipe Bender

HPAC 10—Portable "Handy-Bendy" tool for making quickly a number of uniform bends in any desired degree, including offsets in 1/2 and 3/4 in. pipe, rigid conduit and thin wall conduit — Tal Bender, Inc., Milwaukee 2. It has a measuring gage and bend degree indicator to control precision bends made on the job, and is especially recommended by the manufacturer for use in open or slab work. The tool weighs 30 lb.

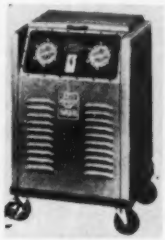


Redwood Cooling Towers

HPAC 11—"Cotospray" cooling towers built of redwood, with bolts, nuts, washers, and nails of galvanized steel — J. F. Pritchard & Co., 908 Grand Ave., Kansas City 6, Mo. The distribution header is of steel, and nozzles are the bronze, non-clogging type. Louvers are 1 in. surfaced redwood, and basins are the leakproof steel pan type (up to and including 10 ft-6 in. x 10 ft size) with redwood side boards bolted to the basin sills. The cooling towers are designed as low cost units, and thermal capacity is guaranteed for the life of the structure.



Cooling Tower



Welder

Heavy Duty Arc Welders

HPAC 12—Heavy duty industrial a-c arc welders in three new models — Trindl Products, Ltd., 17 East 23rd St., Chicago 16. Model 200A operates from 110 or 220 volts, with a heat range of 20 to 200 amp, handling rods up to 3/16 in. on work up to 1 ¾ in. thick. Models 300A and 400A operate from 220 or 440 volt lines, each with 36 different heat stages, ranging from 30 to 300 amp and 400 amp, respectively. These models offer the eye level control panel featured in the rest of the company's line of arc welders.

Room Air Conditioners

HPAC 13*—Self-contained, electrically operated room air conditioning units, for cooling, dehumidifying, filtering and circulating the air in single rooms — Servel Inc., Evansville, Ind. Capacities will be up to ¾ or 1 hp, and the first of the units will be ready early in 1953. Distribution will be handled by the company's appliance and air conditioning distributors.

Concentrator for Liquid Used in Air Drying

HPAC 14—Improved unit for conentrating the liquid drying agent employed in a non-refrigeration method of drying air—Niagara Blower Co., 405 Lexington Ave., New York 17. The liquid, "Hygrol," absorbs moisture directly from the air. As it becomes diluted, a portion of it is pumped to the concentrator. There it is sprayed in an air stream over a heating surface which raises its temperature, evaporating the water. The air stream then passes through eliminator plates which remove the liquid drops, and from there passes over a cooled reflux coil which raises humidity in the chamber and condenses the absorbent vapor. In the third stage, it passes through filtration cylinders containing fog nozzles, where high humidity completes condensation of the absorbent liquid, and its droplets are caught by the filters while the moisture laden

DON'T HEAT THE GROUND UNDER THE BUILDING!

WHERE RADIANT HEATING operates upward from an uninsulated GROUND FLOOR the loss of heat downwards by straight conduction through solids is substantial.

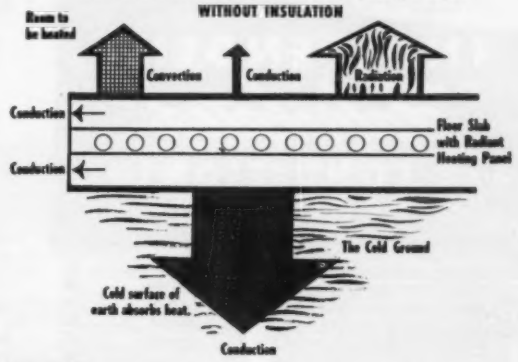
Heat by conduction follows the law that warmth flows to cold, never the reverse; in any direction, down and sideways, as well as up.

Since the ground is colder and more massive than the space above the floor, there will be considerable flow of heat to the earth below as well as the floor above.

The GUIDE of the Amer. Society of Heating and Ventilating Engineers says, *"When the heating pipes are imbedded in a concrete floor slab a portion of the heat emitted by the pipes will flow upward into the space to be heated, and the remainder will flow downward into the ground.*

"When the heating pipes are placed below the concrete floor slab instead of being imbedded in the slab, a larger portion of the heat will flow into the ground, and a smaller portion into the space to be heated."

Heat Flow from Floor Radiant Heating Panel



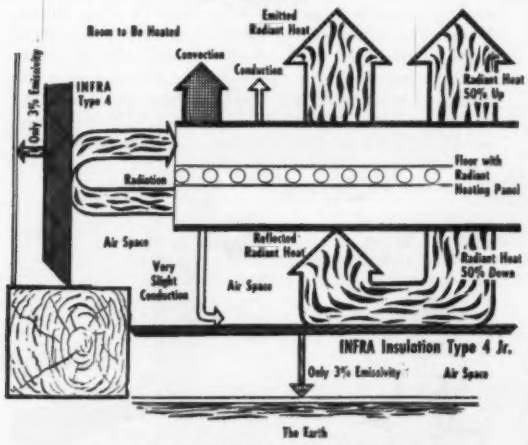
An official research organization in a neighboring country recently conducted numerous tests and found that without insulation under ground floor radiant panels, heat flow *into* the earth was preponderant; in considerable amounts to 6 ft. underground, and extending in lesser amounts to 12 ft.

By installing multiple accordion aluminum with assured air spaces, under the heating panel, MOST of the dissipated heat would be saved for radiant heating, because 95% of CONDUCTION to the earth would be stopped by the air spaces, and RADIATION loss would be only 3%. There is NO CONVECTION downwards.

Six-space and 4 space multiple accordion aluminum have C factors for downheat flow of .044 and .065 respectively, equal to 9" and 6" laboratory dry rockwool. They are non-condensation forming, of zero vapor permeability.

Insulation in relation to radiant heating, with a new technique for floor slabs, is discussed in the fifth edition of "Simplified Physics of Vapor and Thermal Insulation," a complete and concise manual mailed free on request.

Heat Flow from Floor Radiant Heating Panel



INFRA THERMAL FACTORS, DOWNHEAT FLOW

Type 6	C.044 R22.72 equals 9" DRY Rockwool
Type 4	C.065 R15.38 equals 6" DRY Rockwool
Type 4 Jr.*	C.097 R10.30 equals 4 ½" DRY Rockwool

*In 1" Space

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525 Broadway New York, N. Y.

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DIRECTED AIR FLOW
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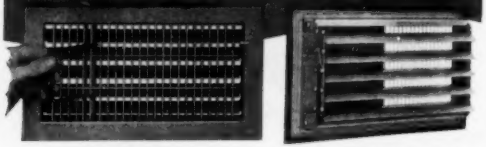
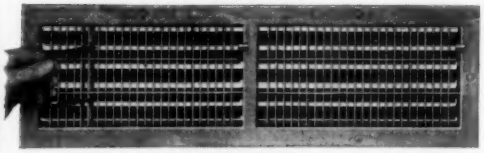


321-A HMV

Rear View Showing "HMV" Vaives

Every grille bar adjustable individually—before or after installation



321-A HMV Tandem

Any direction of air flow—right, left, up, down and any combination—is easily obtained with "Fabrikated" Style No. 321-A HMV air conditioning registers, for residence or commercial installations, on sidewalls or ceiling. The face bars are adjustable to right or left; valves on the back are adjustable to direct the air flow up or down; valves may also be fully closed, and are connected to open or close in unison.

The angles of deflection and the combinations to be had are practically unlimited. Adjustments for directed air flow may be made before or after installation. Grille bars are held firmly in place and will not vibrate or rattle.

"Fabrikated" registers are available in sizes from 8 x 4" to 48 x 24", including tandem style. Special sizes can be made without special die set-up charges.

Write for Catalog No. 50.

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.
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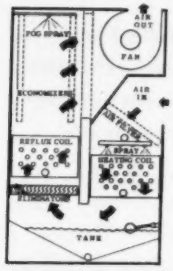
air passes through. The re-concentrated absorbent drains to the tank in the base, from which it returns to the air



Flow Diagram

conditioning unit. This method reduces consumption of the liquid absorbent to a negligible amount, the manufacturer states.

Aluminum Jackets for Insulated Piping

HPAC 15*—Aluminum pipe jackets for protecting outside piping, towers, tanks, vessels, etc., designed to withstand deterioration caused by rain, snow, winter cold or summer heat — Reynolds Metals Co., Building Products Div., Louisville 1. The jackets do not need replacement once installed, and may be re-used, the manufacturer states. Two jacket materials are offered: aluminum sheet bonded to asphalt-saturated felt at the factory; and plain coiled aluminum to be brush coated on one side in the field, with either an asphalt aluminum compound, bituminous plastic, or a roof coating asphalt. The first type needs no preparation, is unrolled, cut to size and applied.

Solder Type Gate Valves

HPAC 16*—"Streamline" solder type, cast bronze gate valves for general service operation in the 125 lb steam working pressure range — Mueller Brass Co., Port Huron, Mich. The valves can be soldered into the line without being disassembled. The design of the valve disc lugs makes it impossible for the disc to be reassembled backwards, assuring a correct match between the valve seats and bronze disc, the manufacturer states. The non-rising stem is intended to allow installation in a minimum space. The valves are available in a complete range of sizes from ½ through 2 in. nominal.

Above: Heater
Left: Valve

Industrial Electric Heaters

HPAC 17—Improvements in two "Chromalox" industrial electric heaters used in the chemical, plastics, paint, metal working and finishing industries — Edwin L.

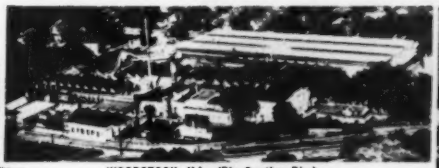
14 AUTO-LITE PLANTS
DETROIT STOKER EQUIPPED

TOLEDO (Ketcham Ave. Plant)
3 DETROIT STOKERS

BAY CITY, MICH. (Bay Mfg. Div.)
3 DETROIT STOKERS

SPRINGFIELD, O. (Springfield Div.)
1 DETROIT STOKER

PORT HURON, MICH. (Wire & Cable Div.) 4 DETROIT STOKERS



WOODSTOCK, ILL. (Die Casting Div.)
2 DETROIT STOKERS

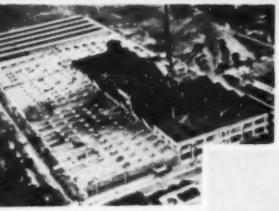
FOSTORIA, O. (Spark Plug Div.)
3 DETROIT STOKERS

SARNIA, ONT. (Electric Auto-Lite Ltd.) 4 DETROIT STOKERS

SHARONVILLE, O. (Bumper Div.)
3 DETROIT STOKERS

CINCINNATI (Lamp Div.)—2 DETROIT STOKERS

FOSTORIA, O. (Foundry Div.)
2 DETROIT STOKERS



LA CROSSE, WIS. (Instrument & Gauge Div.) 3 DETROIT STOKERS

TOLEDO (Stickney Ave. Plant)
2 DETROIT STOKERS

TOLEDO (Champlain Street Plant)—3 DETROIT STOKERS

INCENNES, IND. (Auto-Lite Battery Corp.)—1 DETROIT STOKER

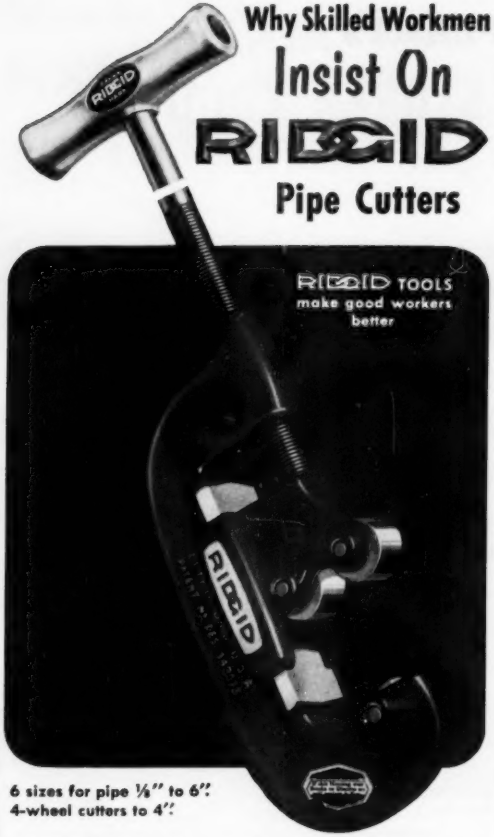
DETROIT STOKERS

36 DETROIT STOKERS SINCE 1929 . . . FOR
THE ELECTRIC AUTO-LITE COMPANY

Overwhelming Evidence of Satisfactory Performance

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

Why Skilled Workmen
Insist On
RIDGID
Pipe Cutters



6 sizes for pipe ⅛" to 6".
4-wheel cutters to 4".

RIDGID Heavy-Duty Cutters assure you extra quick easy pipe cutting

★ High alloy thin-blade cutter wheels roll quickly through pipe with least effort—clean almost burrless cuts.

★ Special malleable housing guaranteed warp-proof, assures perfect tracking of cutter wheel—every tool factory tested.

★ Efficiency-balanced design for quick easy work—made for long hard service.

★ Order from your Supply House.

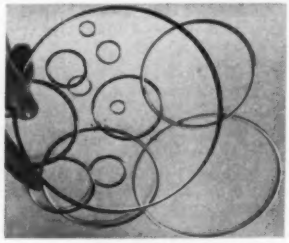
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8. The type TBL electric tank heater (shown) now includes a vaportight terminal box as a standard feature. Tubular elements are welded to the sealed, electrical connection housing and the wiring is brought out to the terminal box through a thick-walled steel pipe. The new design is intended to give longer, safer usage in the presence of corrosive and penetrating vapors. These units are available in steel, alloy, or stainless, with ratings from 3 to 7.5 kw. The type ARMT screw plug unit with explosionproof or vaportight terminal box is now available with a wider built-in thermostatic range. With brass or copper construction for water heating, the range is 50 to 250 F. With steel, for oil heating, it is 150 to 550 F. Ratings are 1.5 to 10 kw.

Combination Filter-Drain for Compressed Air Lines

HPAC 18—Filter-drain which provides automatic removal of liquids and solids from compressed air lines, with automatic drainage of collected liquids — C. A. Norgren Co., 3400 S. Elati St., Englewood, Colo. It operates under constant or fluctuating air pressures and air flow, and continues to operate when the flow of air is cut off, assuring drainage of condensate when equipment is shut down, the manufacturer states. Any sludge or solid particles in the air are filtered out before the air goes to the drain chamber, preventing clogging of the drain. The unit is available in ¼, ⅜ and ½ in. pipe thread sizes for in-line pipe connection installations. It is recommended by the manufacturer for a flow of 0 to 35 cfm at pressures from 0 to 150 psi in temperatures from 40 to 120 F. Applications include air lines to portable air tools, air cylinders and air powered machines, where manual draining is not desired.



Above: Rings
Left: Filter-Drain

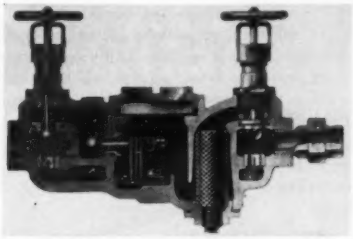
Metallic O Rings for Static Seals

HPAC 19**—Metallic O rings, hollow metal tubing rings filled with inert gas at 600 psi, for positive metal to metal static seals where problems of heat, pressure, corrosive liquids or gases are involved — United Aircraft Products, Inc., 1160 Bolander Ave., Dayton, Ohio. The rings are dimensionally stable under heat or cold, are not affected by age, and are impervious to oils, gases, or aromatic mixtures, the manufacturer states. They can be installed in present ring grooves, in free machined recesses, or, with a special compression limiting device which can be incorporated in the rings, can be installed without grooves or recesses. They will hold against pressures as high as 20,000 psi, according to the company. Standard rings of stainless steel, of mild steel cadmium or nickel

plated are available in experimental quantities in sizes ranging from 11/16 to 40 in. OD in increments of 1/16 in. They will be generally available in the near future. The rings were invented in England, the American company having been licensed to produce the rings here by the Wills Ring Co., Bridge Water, England.

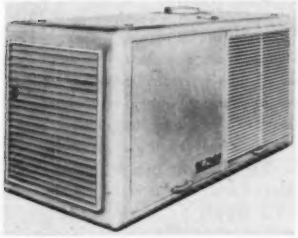
Steam Trap with Signalling Device

HPAC 20—"Universal" bypass type steam trap designed for use in processing industries where uninterrupted operation is essential — Velan Engineering Co., 1 Exchange Place, Jersey City, N. J. Two special valves incorporated in the trap have a signalling device indicating in which position the valves are. The draining device can be completely closed; steam and condensate can be bypassed and all internal parts of the trap replaced, or condensate lines can be cleaned with live steam, the company states. The unit weighs 16.2 lb, combining trap, air vent, check valve, control glass, controller, and bypass. It can be installed in any position, and one type handles pressures from 0 to 350 psi.



Gas Unit-Central Heater

HPAC 21—"Pac" all purpose gas unit or central heater, AGA approved for use in either function with or without ducts — Reznor Mfg. Co., Mercer 8, Pa. The unit operates with natural, manufactured, mixed and LP gases. The 100,000 Btu model measures 22 x 23 x 47½ in. All controls are enclosed within the case. Flanges on both ends of the heater can be fitted with standard louver panels or used to connect ducts. Four tapped sockets are provided on top and bottom for suspended or base mounting. In central heating, use of more than one unit provides zone control and shorter runs of ducts.



Heater

Valve

Valve Series

HPAC 22**—Series 900 valves in both iron pipe and copper to copper stops and stop and waste patterns — Glauber Brass Inc., Kinsman, Ohio. Full waterways are used throughout and a tapered seat gives greater bearing

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"400" POWER DRIVE

On Wheels!

Wheel legs and front handles available to convert your present "400" to wheel model; or legs and tray to make bench model into stand.

Power for hand threaders, cutters, reamers now easily rolled where you need it!

★ *One man* can easily wheel-barrow this popular RIDGID power unit close to the work—think of the time and muscle saving!

★ And it stands still and delivers plenty of power—universal motor, forward, reverse, ⅛" to 2"—to 12" with geared tools.

★ RIDGID design 3-jaw chuck, 6 adjusting pinions, one always handy; self-centering workholder in rear.

★ Sealed-in lubrication—no oil to spill.

★ See it, compare it—buy the unequalled "400" at your Supply House!

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Work-Saver Pipe Tools

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Pioneer in powder-actuated fastening

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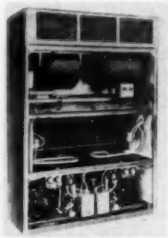
Product Patent No. 2470117. Other Patents pending

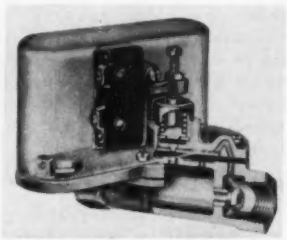
surface, insuring positive shutoff and long service life, the manufacturer states. The valves are streamlined for lighter weight. Sizes are ½ through 1 in., available in all patterns.

Self-Contained Conditioner with Two Refrigeration Circuits

HPAC 23—10 ton upright self-contained air conditioner, for store, office, and other uses, with two complete, separate refrigeration circuits — United States Air Conditioning Corp., 3300 Como Ave., S.E., Minneapolis 14. The dual circuit is designed to provide economy of operation when the full cooling capacity is not required, and to enable the equipment to meet the usual local code requirements. A manual bypass damper in the blower section permits increased dehumidification without excessive cooling and semi-hermetic compressor sections minimize space requirements, according to the manufacturer. There are pressure relief valves on the condenser-receivers, a charging valve on the liquid line, and a separate magnetic starter for the fan motor. Both 5 ton circuits are set up on a "pump down" cycle, line solenoid valves and low pressure control being utilized to provide satisfactory operation of the cycle.



Conditioner



Interlock

Automatic Interlock for Fluid Flow Rate

HPAC 24*—"Shur-Flo" automatic interlock, a protective device which operates an electrical control switch that renders equipment inoperative, or operates an alarm, when the flow of water, air, or light oil in supply lines deviates from requirements for operating efficiency — Hays Mfg. Co., 801 W. 12th St., Erie, Pa. Designed to prevent damage to the equipment, the interlock is available in two types, one shutting off operation when flow falls below a predetermined minimum, and the other, when supply exceeds a given maximum flow rate. The device operates on a differential of flow pressure across a nozzle. The electric switch makes or breaks contact in accordance with the movement of the lever arm and plunger that transmits the diaphragm action to the switch. A protective strainer is not required. Uses include protection of fluid-cooled industrial controls and industrial equipment, maintenance of the coolant supply to bearings, etc.

Pipe and Bolt Threading Machine

HPAC 25—"Ridgid 500" pipe and bolt threading machine with new type of self-contained die head — The Ridge Tool Co., Clark St., Elyria, Ohio. The "Quadritype" die head is instantly adjustable to thread 1 to 2 in. pipe, including over and under size, regardless of the position of

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INFORMATION FOR MAKING SOLDERED FITTING CONNECTIONS
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the lever and without requiring removal of dies or die head from the machine. The "Dualtype" die heads, one for 1/4 and 3/8 in., and another for 1/2 and 3/4 in., are also adjustable in this way. "Monotype" die heads, 1/8 to 2 in., and bolt die heads, 1/4 to 2 in., which adjust to over and under size in the machine, also are available. All tools in the new machine cut and ream independently, close to the chuck, and swing up out of the way when not in use, the manufacturer states. The thread oil system is entirely concealed. The motor is a universal forward-reverse type, operating on 115 volts, 25 to 60 cycles, a-c or d-c single phase, light socket power. The tool is available in bench and stand models, the latter open or closed, with or without wheels.

Pipe machine

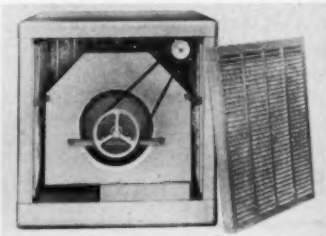
Filter

Grease Filter

HPAC 26—"Airsan" grease filter, newly designed with extra grease holding capacity, for preventing entrained oil from entering exhaust ducts — Air Filter Corp., Milwaukee. It is intended to prevent fire hazards and prolong the life of fan motors and other mechanical equipment. The filters, which have electroplated woven wire cloth media and expanded metal face plates, are available in unit assemblies for wall or ceiling types, and in single or multiple units.

Evaporative Air Coolers

HPAC 27—Five new "Down Discharge" evaporative air coolers, ranging in capacity from 3700 to 6600 cfm — Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21. The coolers are so constructed that the cool air discharges through the bottom, permitting simple installation on roofs. They may be installed without exterior ductwork.



Above: Cooler

Right: Burner

Combination Oil-Gas Burner

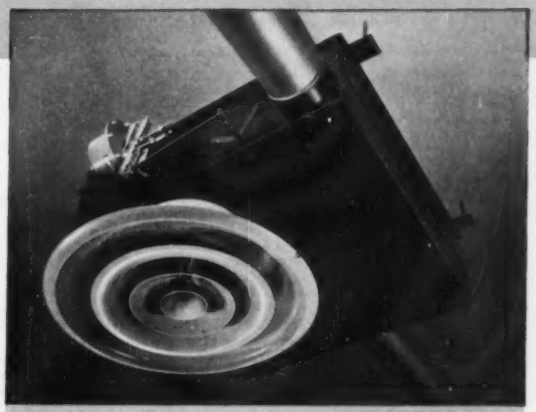
HPAC 28 *—Combination oil-gas burner for use with the complete line of "Thermobloc" industrial type forced warm air direct fired heaters — Prat-Daniel Corp., 2 Mead-

ANEMOSTAT *Announces*

NEW HIGH PRESSURE ASPIRATING UNITS

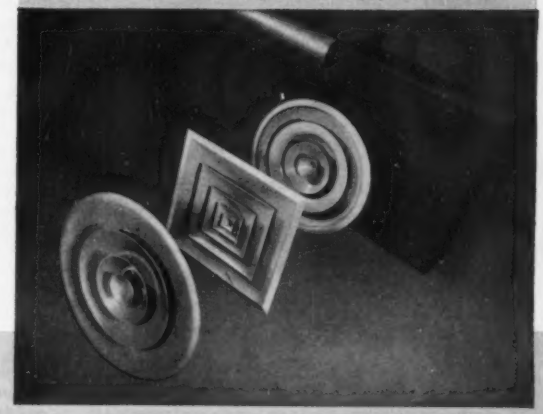
Here's your answer to high pressure air distribution problems—Anemostat High Pressure Aspirating Units. These units consist of a combination of static pressure reducing valve and ingeniously designed sound trap, and one of several types of Anemostat Aspirating Air Diffusers. Primary air is brought to the unit at velocities up to 4,000 fpm and static pressures up to 4 in. wg. Static pressure is reduced and the sound of the air attenuated to acceptable limits. The air at low static pressure is delivered to an Anemostat Aspirating Air Diffuser to assure draftless air distribution.

Write for Bulletin No. 41



High pressure double duct with Type C-1 diffuser.

Various Anemostat air diffusers may be used on high pressure installations.



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Double check the time-cost of assembling pipe hangers with the pipe. That's one way to get a conviction that pipe hangers can be time-cost saving tools. Then, use Square "Gee" Pipe Hangers on your next plumbing and heating jobs and you'll know for sure that pipe hangers can reduce installation cost because Grabler Square "Gee" Pipe Hangers give relief from time-wasting grief. Ask your wholesaler for Grabler Square "Gee" Pipe Hangers.

Write for Wall Chart showing complete range of types of Grabler Square "Gee" Pipe Hangers and accessories.

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Approved by Underwriters' Laboratories

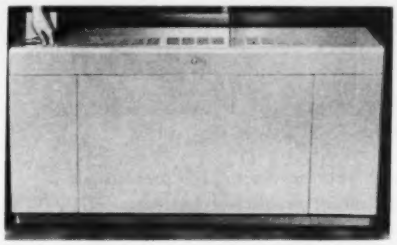
Approved by Underwriters' Laboratories

GRABLER

ow St., South Norwalk, Conn. There is instantaneous change-over from gas to oil or oil to gas, and no piping or burner changes are needed, according to the manufacturer. Change-over may be automatic (with an outdoor thermostat which can be adjusted to a change-over thermometer) or a manual pushbutton may be used. Automatic change-over occurs during the cold snaps that place a drain on supplies.

Remote Type Room Air Conditioner

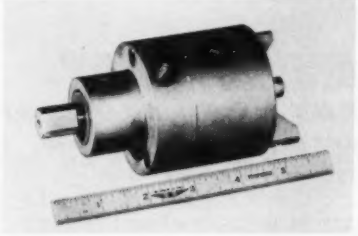
HPAC 29*—"Remotaire" remote type room air conditioner for multiple installation that provides both summer cooling and winter heating — American Radiator & Standard Sanitary Corp., P.O. Box 1226, Pittsburgh 30. Designed for installation in office buildings, hotels, etc., it is connected to centrally located water heating and cooling plants, offering individual control of temperature in each room without affecting adjoining spaces. It can be



installed in either a free standing or recessed position under most windows. The large model has twin centrifugal fans which deliver 400 cfm of conditioned air. The smaller model uses a single fan to deliver half that volume. Ventilation air comes from outside the building, through a wall aperture behind the unit. Both ventilation and recirculated air are filtered separately before blending within the fan unit.

Small Displacement Pump

HPAC 30**—"Magna-Mite" positive displacement pump for handling fuel oil, gasoline, hydraulic fluid, lubricating oils, and other light viscosity fluids — Milwaukee Hydropower, Inc., 3447 N. 35th St., Milwaukee 16. Capacities range from 1½ down to ¼ gpm or less. The pump has a diameter of 2¾ in., and is 6 in. long. In it, conventional vanes are replaced by rollers which



contact the outer case as in a roller bearing. Rolling friction, thus, replaces sliding friction between the vanes and the pressure chamber, resulting in longer pump life, according to the manufacturer. The action of the rollers against the pressure chamber induces the formation of an oil wedge between the contacting surfaces. The pump

Driving motors for this mill, which will develop 21,000 hp, couldn't operate for long without costly maintenance if they didn't "breathe" clean air

ELECTRONS SCRUB THE AIR FOR BIGGEST PLATE MILL

Over in Coatesville, Pa., Lukens Steel Company operates the biggest steel plate rolling mill in the country. This behemoth swallows 55-ton ingots and spews them out as plates up to 195 inches wide. Electrical equipment driving the rolls is as big and tough as the job demands. Yet dirt particles so small you can't see them can bring the whole operation to a standstill.

How? Minute airborne particles build up on windings—cause overheating, fire or electrical failure. Answer? Westinghouse PRECIPITRON® for electronically cleaning the motor ventilation air. This electronic air cleaner takes over where other air cleaning devices give up. It is so efficient it traps even the microscopic particles that make up smoke.

This efficient electronic air cleaner—PRECIPITRON—has meant remarkable operational savings in many ways to industrial plants, commercial buildings, laboratories—even homes. You'll find it worthwhile to see if Westinghouse can help you *put air to work*, too—with air cleaning, air conditioning or air handling. Call your local Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

These PRECIPITRON units clean 200,000 cfm of ventilating air for Lukens' mill motor and control room.

Six AXIFLO® Fans develop steady pressure to draw air through PRECIPITRON, force it into motor room.

Five SILENTVANE® Fans draw the cleaned air through mill motors and generators to cool them.

YOU CAN BE SURE...IF IT'S

Westinghouse

J-80239

Maintenance men can forget about the jobs that are done with Amocel, for time means virtually nothing to this "permanent" pipe insulation. It's Unarco's exclusive development for low-cost commercial use on steam and hot water lines and for all other work within 600°F., maximum. Amocel has many of the fine extra-service features formerly found only in Unarco's higher-temperature insulation, Unibestos. You'll like its easy application; its money-saving, long-lived efficiency.

UNARCO

Write for Bulletin No. 76-109, and the name of the Unarco Warehousing Distributor in Your Area

UNION ASBESTOS & RUBBER COMPANY

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UNARCO

Distributor of the Month

Allied Services, Inc.

SPRING & BULLITT STREETS

P.O. STATION A

CHARLESTON, W. VA.

Serving the Tri-State area of West Virginia, and Eastern Ohio and Kentucky from warehouse stocks in Charleston (and soon in Parkersburg), Allied Services, Inc., offers insulation users full engineering cooperation and Unarco product-quality.

Ample supplies of Unarco pipe insulations—Unibestos and Amocel—as well as Unarco Packings, Textiles, Insulating Blankets, and Sound Absorbing Blankets, assure prompt delivery for a wide range of diversified uses.

Phone Allied Services for well-informed recommendations and application suggestions, and for dependable Unarco insulations from stock. The telephone numbers in Charleston are 2-7431 and 6-0494.

UNARCO Insulations

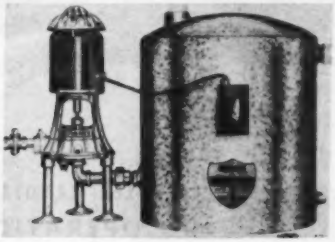
PRODUCTS OF

UNION ASBESTOS & RUBBER COMPANY

is available in three types: contact displacement, adjustable displacement (illustrated), and variable and reversible displacement.

Condensation Return Unit

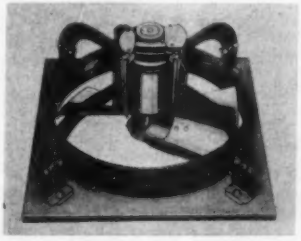
HPAC 31**—"Advance Heatsaver" condensation return unit for use in industrial plants requiring circulating hot water, air conditioning service or boiler feed — Advance Pump Co., 2531 9th St., Berkeley, Calif. The unit



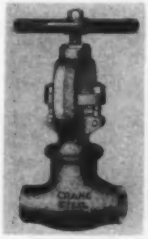
consists of a vertical, high pressure type centrifugal pump with a ¼ hp single phase motor and a 20 gal galvanized tank with float switch. Pumping capacity is from 2 to 33 gpm, at discharge pressures ranging from 4 to 60 lb. It is 25 in. wide, 35 in. long, and 23 in. high.

Propeller Fan

HPAC 32—Model MDA direct drive, vertical, propeller fan for exhaust use in laboratories, etc., which is installed flush with the ceiling — Herman Nelson Div., American Air Filter Co., Inc., Moline, Ill. The totally enclosed motor and motor mountings are concealed by the ceiling itself. Blade size ranges from 14 to 36 in. A variety of motor sizes are available, and delivery varies from 1585 to 12,400 cfm. The fan is also offered with acid resisting varnish for applications where corrosive fumes are handled.



Fan



Valve

Small Steel Bonnet Joint Valves

HPAC 33—Small steel valves with "Lip-Seal" bonnet joint, for high pressure, high temperature services — Crane Co., 836 S. Michigan Ave., Chicago 5. They are currently being made in the globe and angle patterns in both the 1500 and 2500 lb pressure classes. The bonnet joint is designed to provide absolute joint tightness, minimum weight and bulk, and ease of dismantling and reassembling. It consists of long body-bonnet threads which are pulled up until contact is made between the flat surfaces on the shoulder of the bonnet and the top of the body. The small lips around the edge are then seal welded. The valves also have a disc-stem connection which retains the swivel

York County Home Annex, York, Pa. Architect: Clair S. Buchart, York, Pa. Engineer: William K. Hood, York, Pa. Heating Contractor: C. C. Kottcamp & Son, York, Pa. Floor type Radiant Heating System divided into 13 zones, each controlled by type STA-1 Sarcotherm controls and "Thermoray" comfort thermostats.

ENGINEER-MANUFACTURER
CO-OPERATION
results in perfect comfort

WITH
Sarcotherm
RADIANT HEAT CONTROL

• The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.

Here is a striking example of the advantages of close cooperation between the architect's designing engineer and an equipment manufacturer who not only offers complete weather compensated control systems for hot water and radiant heating, but can supplement this with 30 years' experience and the most complete line of accessories for all types of heating.

In the case of York County Home Annex illustrated, engineer William K. Hood, York, Pa., designed a radiant heating system divided into 13 zones, each individually controlled by Sarcotherm.

An important feature of the control system is the unique "Thermoray," a very sensitive heat loss thermostat, influenced by both radiation and convection.

Sarcotherm also regulates supplementary baseboard heating, and unit heaters.

Send us your next problem—there is no obligation. Or write for complete catalogue.

22-A

• The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

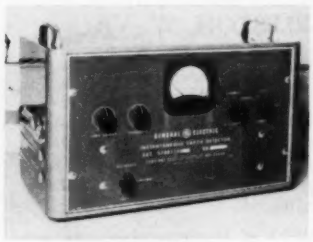
Sarcotherm CONTROLS, INC.
EMPIRE STATE BUILDING · NEW YORK 1, N. Y.

A SARCO PRODUCT

feature, but eliminates all avoidable looseness of parts, minimizing chances for disc vibration, the manufacturer states. Sizes are ½ to 2 in., inclusive, with either socket-welding or screwed ends.

Portable Mercury-Vapor Detectors

HPAC 34—Type A (electronic) and Type B (chemical) redesigned portable mercury-vapor detectors for indicating concentrations of mercury which could be harmful to industrial workers — General Electric Co., Schenectady 5, N.Y. The electronic instrument (illustrated) indicates mercury vapor by resonant absorption of ultraviolet energy. It gives instantaneous readings ranging from 0.01 to 3.0 milligrams of mercury per cubic meter of air, and features greater operational stability independent of line voltage, the manufacturer states. The chemical detector utilizes the principle that activated selenium sulphide, deposited on a thin sheet of paper, will darken in the presence of mercury. It is designed for continuous monitoring and to indicate as little as 0.10 milligrams of mercury per cubic meter of air in two hours.



Detector

Dehumidifier

Electric Dehumidifier

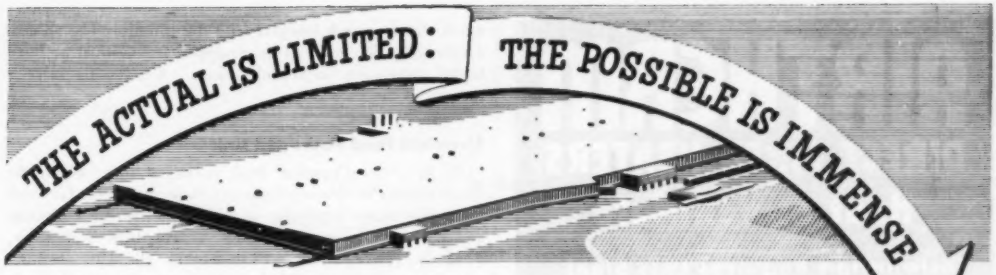
HPAC 35**—Model ACD-28 electric dehumidifier, designed to remove up to 12 quarts of moisture from the air in 24 hr, and to control humidity in closed areas up to 8000 cu ft — RCA Victor Div., Radio Corp. of America, Camden, N.J. It is operated by a ⅛ hp compressor which is hermetically sealed and permanently lubricated.

Corrosionproof Plastic Pipe

HPAC 36**—Corrosionproof plastic pipe for use in mining operations, petroleum production, water wells, chemical processing, and general piping of pure or corrosive liquids and gases — The Plastex Pipe and Extrusion Co., 402 Mt. Vernon Ave., Columbus 3. The pipe is extremely lightweight, resists rust, rot, and electrolytic corrosion, and has a smooth interior surface providing maximum transmission, the manufacturer states. Connections are made with cemented plastic fittings. The pipe comes in a complete range of standard pipe sizes from ½ to 6 in. Coils are made up to 400 ft long, and straight lengths, 25 ft long.

Pneumatic Reversible Impact Wrench

HPAC 37—"Thor" ⅜ in. portable pneumatic reversible impact wrench, incorporating a rolling ball type cam — Independent Pneumatic Tool Co., 175 N. State St., Aurora, Ill. It is available with two types of spindles, one with ½ in. square drive, the other with a 7/16 in. hexagon



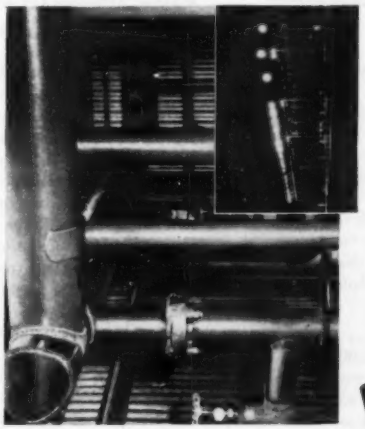
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1952

IMPROVES HEATING EFFICIENCY WITH WELDED PIPING

ARC welding the radiation piping direct to the grandstand framing has achieved an efficient heat transfer system at low cost. The radiant heating system involves 13,700 feet of pipe, ranging from 1¼" to 3" diameter. The design provides for an average 30 degree rise in temperature over the outside readings and costs only $1.17 per square foot.

Cumbersome and costly methods of hanging pipe with carriers have been eliminated by welding black iron pipe to the welded steel framework. The pipe has the same coefficient of expansion as steel, permitting the solid, unit construction, virtually integrating the grandstand into one giant radiating unit. Welding also enables headers and other fittings to be fabricated at low cost right on the job. It permits pipe to be installed in restricted areas where traditional methods would be costly and often impossible.



Simpler Construction *of heating system at Sportsman's Park, Phoenix, Arizona, is made possible with welded pipe. Headers and supports are fabricated at low cost from pipe. Resulting construction is permanent and trouble free.*

SIMPLIFIES CONSTRUCTION

Maximum Flow *of hot water through circulating system is assured with welded piping. System is 1¼" pipe welded direct to deck plates to give maximum transfer of heat to grandstand frame.*

SPEEDS INSTALLATION

Eliminates Hangers *by arc welding hot water piping direct to treads and risers, using Lincoln "Fleetweld" 5" electrodes and "Shield-Arc" DC welders.*

*Preferred standards for electrodes and welders on quality work

CUTS COSTS

Bulletin 403, Welding Guide, free on request. Write to Dept. 281,

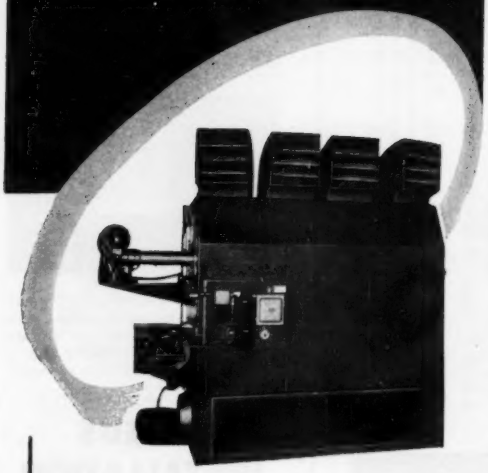
THE LINCOLN ELECTRIC COMPANY

Cleveland 17, Ohio

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

AIRTHERM
DIRECT FIRED HEATERS
Heat or Ventilate

Installation Requires Less Steel Than Other Type Heating Systems ...Insure Customer Satisfaction



The Airtherm Space Heater has been designed with extreme flexibility for heating as well as ventilating steel plants, foundries, all types of industrial buildings and warehouses. They are quick, easy, and less costly to install and require less duct work and scarce materials. They are furnished complete with all operating and safety controls for automatic operation. Airtherm Space Heaters have a heavy duty steel combustion chamber lined with castable refractory for simple maintenance and long life.

AVAILABLE IN 9 MODELS — Oil* or gas fired — ranging from 650,000 to 2,000,000 B.T.U. per hour output, in floor mounted or suspended types. Write for Bulletin **802A** for complete information.

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AIRTHERM MANUFACTURING CO.
711 South Spring Avenue
St. Louis 10, Missouri

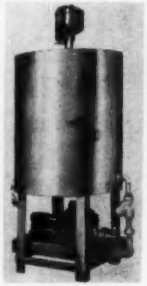
*Approved by Underwriters' Laboratories

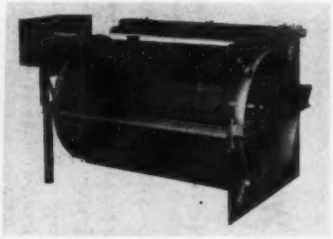
For Complete Customer Satisfaction... Think First of **AIRTHERM**

quick change chuck integral with the spindle. The wrench weighs 5¾ lb, and can be equipped for vertical or horizontal suspension on assembly lines. A reversing valve is located at the back.

Chemical Feed Packaged Unit

HPAC 38*—Chemical feed packaged unit, which delivers liquids in desired amounts under pressure, for feeding boiler water treatment as well as delivering chemicals and other fluids for processing — The Bird-Archer Co., 4337 N. American St., Philadelphia 40. The chemical reservoir tank is of welded steel construction, available in 50 or 100 gal capacities. The chemical proportioning pump can be designed for various rates of feed at different pressures. A motor driven agitator assures completely mixed fluids at all times, the manufacturer states. A stainless steel strainer is provided between the suction side of the pump and the tank, and the pump is mounted below the tank to minimize air binding and to maintain a positive suction head. A duplex pump model is also available.





Above: Strainer
Left: Feed Unit

Suction Strainer for Air Washers

HPAC 39—Type B automatic suction strainer, a self-cleaning rotary strainer for air washers — Bahnson Co., 1001 S. Marshall St., Winston-Salem, N.C. The strainer automatically removes lint and other foreign matter from all water recirculated by the washer pump. It is preferably located in a compartment within the water tank at the entering end of the washer. The compartment is partitioned from the tank so that all water passes through the strainer cylinder and then to the pump suction line. At controlled intervals, the cylinder rotates and water is supplied to the flushing nozzles of the strainer. As the lint-laden section of the perforated screen passes under the sprays, the lint is washed off into a collecting pan within the cylinder and then drained away. Control is by an adjustable electric timer or a float switch. The straining cylinder is perforated stainless steel. Capacity is up to 550 gpm per strainer, and the motor is 1/6 hp, single phase enclosed gear type (110 or 220 volt, 60 cycles). A water turbine is used in certain applications. Operating water requirement is approximately 35 gpm.

Safety Relief Valve

HPAC 40—Type F-51 safety relief valve for use on hot water space heating boilers, tanks, and heaters — A. W. Cash Valve Mfg. Corp., Wabash and Morgan, Decatur 60, Ill. It is offered in pressure settings from 30 to 125 lb, with corresponding Btu ratings at various pressure settings.

YOU CAN MAKE
MORE INSTALLATIONS—
MORE MONEY
WITH

Curtis

REFRIGERATION
and AIR CONDITIONING
EQUIPMENT

The broad Curtis line—¼ through 40 tons—enables Curtis Distributors to handle the most profitable air conditioning and refrigeration jobs in their areas. And because Curtis equipment reflects the many advantages gained from almost a century of accumulated experience in engineering, designing and manufacturing, you can depend upon customer satisfaction.

Curtis Air Conditioning is advertised in the **Saturday Evening Post, Time, Newsweek,** and other national publications.

Mail coupon for details concerning a direct factory franchise.

Water-cooled Condensing Units —through 40 tons

Evaporative Condensers, Cooling Towers and Air Handling Units to match

Central Type Air Conditioning —10-15 ton

Package Type Air Conditioning —2-4-6-8 ton

98 Years of Successful Manufacturing Experience is "Built-In" Curtis Equipment

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REFRIGERATING MACHINE DIVISION
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I am interested in direct factory franchise. Send complete details.

Company Name _____

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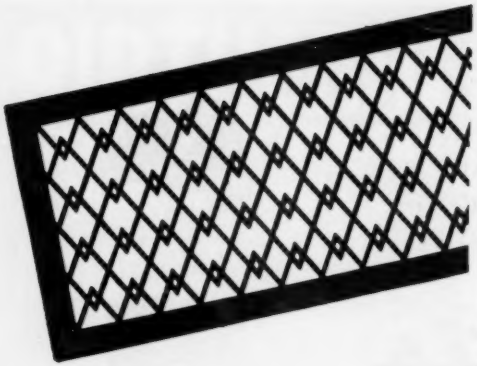


To harmonize with any decorative motif

there's a choice of over one hundred Hendrick Ornamental Grilles

Ornamental grilles, usually being the largest and most conspicuous article of hardware in a room, are a prominent factor in any decorative scheme, and from the wide range of Hendrick designs it is easy to select a grille to meet any requirement.

Hendrick Grilles can be supplied in a wide range of overall dimensions, bar sizes, number of perforations and size of perforations. Ample open areas assure a good air flow, the design illustrated, M No. 9, having 67% open area.

Made in accurate sizes from heavy gauge metals, Hendrick Grilles have no burrs or other imperfections, and always lie flat and are easy to install because of a special flattening operation in their manufacture. Write for detailed information.

SEE OUR CATALOG IN SWEET'S

Perforated Metals
Perforated Metal Screens
Wedge-Slot Screens
Architectural Grilles
Mitco Open Steel Flooring,
Shur-Site Treads, Armorgrids

HENDRICK
Manufacturing Company
48 DUNDAFF STREET, CARBONDALE, PA.
Sales Offices in Principal Cities

It was developed to conform with the recommendations of the National Board and ASME stating that safety relief valves should be sized according to the Btu generating capacity of the boiler. The valve has sufficient capacity to relieve pressure due to thermal expansion of water and steam, which is caused by failure of the firing device to be shut off.

Valve

Cooler

Split-Type Crane Cab Cooler

HPAC 41—3 hp split-type crane cab cooler designed to maintain a temperature of 80 to 85 F within a cab when the surrounding ambient temperatures reach 130 F — Dravo Corp., Air Conditioning and Combustion Dept., Dravo Bldg., Pittsburgh 22. The unit, which supplies continuous ventilation, is equipped with electric strip heaters for winter heating, dust and dirt filters and activated carbon canisters for fume and odor removal. Operation and control for summer and winter are fully automatic. The evaporator section can be installed within the cab, while the condenser section (illustrated) may be located on the crane.

Self-Contained Air Conditioner

HPAC 42—Model MU-101 "Unitaire" air conditioner, a 10 hp, self-contained unit for offices, markets, stores, manufacturing areas, etc. — Westinghouse Electric Corp., Air Conditioning Div., 200 Readville St., Hyde Park, Boston 36. Two 12 in. double inlet fans nominally deliver 4000 cfm. The fan section can be mounted either on top of the cooling section or at the side, and can be rotated for six different discharge arrangements when top-mounted, five when side mounted. The cabinet is thermal and sound insulated with glass fiber and aluminum foil, is 91 in. high when top mounted, 62 in. when side mounted. Accessory heating coils can be provided.

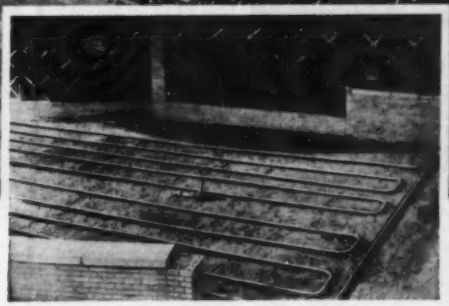
Above: Indicator
Left: Conditioner

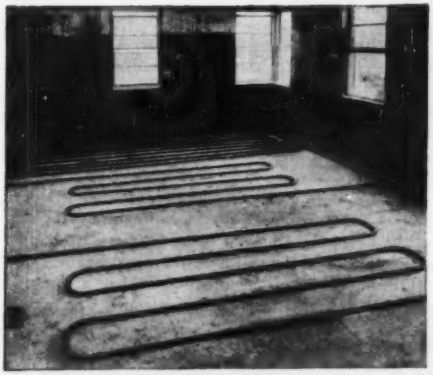
Humidity and Temperature Indicator

HPAC 43**—Model 186 "Hygrodial" direct reading humidity and temperature indicator — Abbeon Supply Co. (distributor), 179-15 Jamaica Ave., Jamaica 32,

Convalescents now more comfortable...

with radiant heating and snow melting





● You'll look a long time before you find a building more ideally suited to the needs of the convalescent. It's the Brooklyn Jewish Home for Convalescents in Far Rockaway, N. Y.

They used 27 tons of National Steel Pipe for the radiant heating and snow melting installation. Every room has radiant heat—the ideal heating system for the aged and the ill.

To make full use of the terrace year round, a snow melting system was installed using National Steel Pipe. Now, patients can utilize the sun-bathed terrace in all but the very worst weather.

National Steel Pipe has been used for many radiant heating systems in homes, institutions and industrial plants. The pipe is made to the same rigid standards that have made National the preferred pipe for conventional heating for over *60 years*.

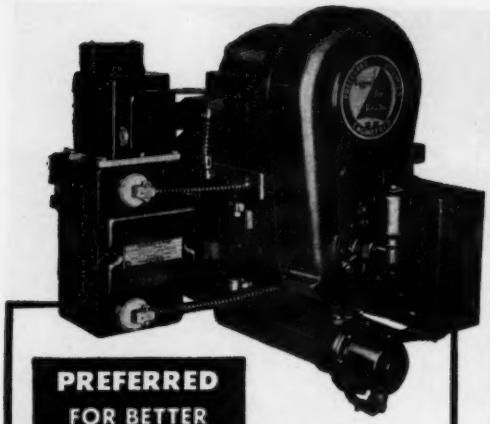
If you have any questions regarding pipe for radiant heating or snow melting, make use of our wide experience. We think we'll be able to help you.

NATIONAL TUBE DIVISION, UNITED STATES STEEL COMPANY, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S NATIONAL Steel PIPE

USS

UNITED STATES STEEL



PREFERRED
FOR BETTER
PERFORMANCE

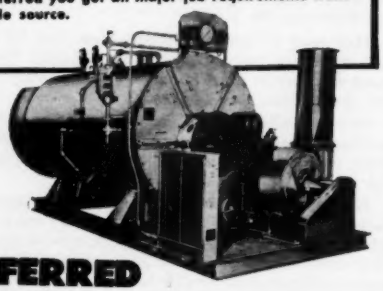
LOWEST INSTALLATION COST

That's right! To install a Preferred Horizontal Rotary Oil Burner costs less than any other industrial oil burner. Exclusive and patented features cut time and labor needed for wiring, brickwork and piping. For example, all basic burner components are completely wired to the terminal junction box. Preferred has been able to lower installation costs because of their years of experience as a dealer, installer and distributor of oil burners. And they have put this practical experience to work for you.

Originally designed to meet the exacting requirements of the Preferred Unit Steam Generator, its fully automatic operation with residual fuels proved so successful that it has won wide acceptance for conversion applications.

It is available with associated Preferred products such as enclosed, pre-wired, union approved panels as well as pump and heater sets where applicable.

At Preferred you get all major job requirements from a single source.



PREFERRED
Unit Steam Generator

The Preferred Unit Steam Generator is a custom-built boiler designed to maintain its guaranteed efficiency for a quarter of a century with a minimum of maintenance. It is the result of 28 years of combustion experience combined with the latest technical advances in pressure vessel design. That is why the Preferred unit offers the lowest installation cost, greatest economy and longest life of any steam generator.

Write for Burner Bulletin 175, Generator Bulletin 1000 and material cost estimates on your application.

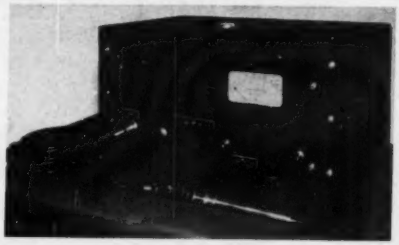
PH-408

PREFERRED UTILITIES
MANUFACTURING CORPORATION
1860 BROADWAY, NEW YORK 23, N. Y.

N.Y. The humidity scale is 2½ in. long and is graduated into equal divisions covering the range of from 0 to 100 percent relative humidity. The humidity sensing element is a multiple strand of human hair. Linearization of the hairs' non-uniform extension is accomplished by means of a cam, assuring uniform accuracy over the entire relative humidity range, the company states. The temperature scale, 1½ in. high, covers a range of 0 to 100 F.

Ultrasonic Viscosimeter for Continuous, Automatic Viscosity Measurement

HPAC 44**—"Ultra-Viscoson" for continuous, automatic viscosity measurement using ultrasonics — Rich-Roth Laboratories, 673 Connecticut Blvd., East Hartford 8, Conn. The hermetically sealed probe, about the size of a fountain pen, has no moving parts, operates to 650 F, 10,000 atmospheres pressure, and is installed permanently



in pipe lines, production kettles, or used in test tubes and beakers. The electronic computer, which can be located up to one mile from the probe, indicates viscosity of Newtonian materials from 0-50,000 centipoises x grams/cc. in 4 decades: 0/50/500/5000/50,000, the company states. Apparent viscosity of non-Newtonian materials is measured over a much greater range. Connection to a recorder or controller provides continuous charts or automatic control.

Aluminum Insulation

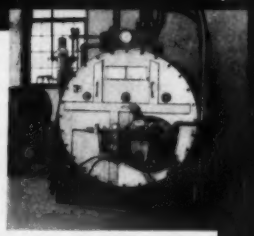
HPAC 45—Type "H" heavy duty multiple accordion aluminum insulation, now strengthened through the conversion of the "peak" aluminum sheet to 0.002 in. thickness and the flat sheet to 0.001 in. thickness — Infra Insulation, Inc., 525 Broadway, New York. On the line for 16 in. centers, the conversion is already in effect. On the 24 in. line, conversion will take place as existing stocks are replaced. According to the manufacturer, the flat sheets of the new weight have a bursting strength (Mullen test) of 20 lb per sq in., with a tearing strength of 35 grams (Elmendorf test); the other sheet has a bursting strength of 52 lb and a tearing strength of 80 grams.

Reinforced Plastic Tubing

HPAC 46**—Thermosetting plastic and "Fiberglas"-reinforced tubing, for fuel-dispensing lines, sanitary natural gas, and salt-water piping, etc., now in continuous production — Reflin Co., Dept. B-11, 8525 Higuera, Culver City, Calif. The pipe is corrosion-resistant (to weather, soil, corrosive liquids and gases, including dilute fatty acids, dilute alkalis, alcohols, gasoline, etc.). It is available in standard sizes from 4 to 10 in. OD with wall thicknesses ranging from 0.030 in. Sizes up to 36 in. OD are available to order. According to the manufacturer, the tubing

You are cordially invited to take a four-plant tour to inspect "packaged" EconoTherm Installations

. . . see how much OWNERS SAVE on fuel and labor with Dutton BOILERS



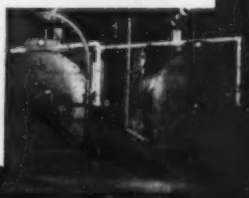
BIG RAILROAD SAVES $5,000 YEARLY WITH ECONOTHERM!

Talk first to roundhouse officials of one of America's greatest railroads*. One Dutton EconoTherm, used for roundhouse heating and hot water supply through *just the colder months each year* has made actual savings pegged at $5,000 per year! Automatically operated, it needs but a few minutes' checking daily. Former equipment required 24-hour-per-day attention.

* Name on request

STOKELY-VAN CAMP, INC., FINE FOOD PACKERS, LIKES ECONOTHERM'S FLEXIBILITY, ECONOMY

At Lakeland, Minn., stop at the sign of Stokely's Finest Foods and World Famous Van-Camp's Pork & Beans. H. H. Young, Chief Engineer, says: "The flexibility of Dutton Boilers fits well into our needs. We have a saving in boiler room labor . . . It is possible to operate with 50% less labor than previously . . . Particularly pleased with service rendered by your representatives."



ECONOTHERM UPKEEP IS ALMOST NIL AT THE CENTURY BRICK CO., MONROE, LA.

J. P. Humble, owner, can show you a gas-fired EconoTherm used around the clock, 5 or 6 days weekly, in curing sand lime brick and new, light building blocks. "In use since 1948 . . . upkeep cost practically nil . . . only shutdowns due to annual inspection or minor repairs of other machinery . . . could not make a more satisfactory purchase than a Dutton EconoTherm."

AT EVANSVILLE, INDIANA, THE WATER WORKS PLANT SUPT. SAYS "WELL PLEASED!"

And there are hundreds of others!

To get more facts first-hand, why not talk to Dutton owners near you? Contact Dutton — or ask your nearby Dutton Representative for the location of installations you can tour yourself! When you write, ask for EconoTherm Bulletin EC-100 G*

* See Yellow Pages in Phone Book.

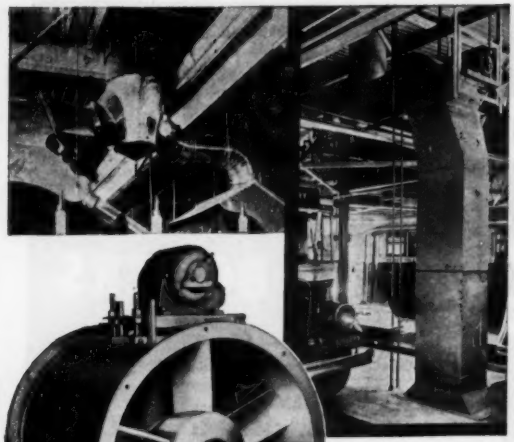
Dutton BOILERS

CHECK FIRST with Dutton

DIVISION HAPMAN-DUTTON COMPANY

KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

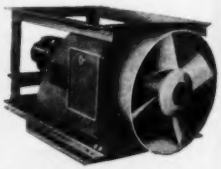
FOUR TYPES — SIZES FROM 5 H.P. UP



Upper left: Wingfoil Straight-Line Duct Fan in Textile Mill. Upper right: Wingfoil Elbow Type Duct Fan exhausting gases in a Garage.

Wingfoil Straight-Line Duct Fan

Wingfoil Elbow Type Duct Fan



WINGFOIL DUCT FANS DELIVER LARGE AIR VOLUMES with Low Power Consumption . . .

The Wingfoil Axial Flow Duct Fan, in either elbow type or straight line type, is a compact, economical fan designed to operate against static pressure. Both types have the motor outside the casing, unaffected by hot or dirty gases. Light weight, compact, easily handled, they may be inserted into a line of duct, either as an elbow or a straight section.

Write for Bulletin F-10

L. J. Wing Mfg. Co. 140 Vreeland Mills Rd. Linden, New Jersey

Factories: Linden, N. J., Montreal, Canada

Wing AXIAL FLOW DUCT FANS

has a tensile strength up to 35,000 psi and a flexural strength up to 65,000 psi; varying with diameter and reinforcement, burst pressures range to 3000 psi.

Tubing

Aquastat

Aquastats

HPAC 47—L4006 series aquastats for hot water boilers, with an improved liquid expansion sensing element for rapid detection of and response to temperature changes —Minneapolis-Honeywell Regulator Co., 2641 4th Ave., S., Minneapolis 8. Switching is accomplished by a completely enclosed pin-plunger snap switch, and the control point can be set externally without removal of the cover. On the well type, the device can be installed from the front, eliminating the need for reaching tools around insulation and piping. The aquastats without a well, or the direct immersion type, are also easy to install, since there is no need to swing the whole control to make the connection, the manufacturer states. The instruments are mounted with the element inserted horizontally into the vessel. Six models are available to make or break contact on temperature rise or with SPDT action. When used as controllers in hot water heating systems, the aquastats are designed for installation directly in the boiler. They may be installed in the supply line to the indirect water heater, in the heater itself, or in a fitting in the feed riser about 6 in. above the boiler. Used on a steam job for summer-winter systems, they are located in the boiler, 4 in. below normal boiler water line.

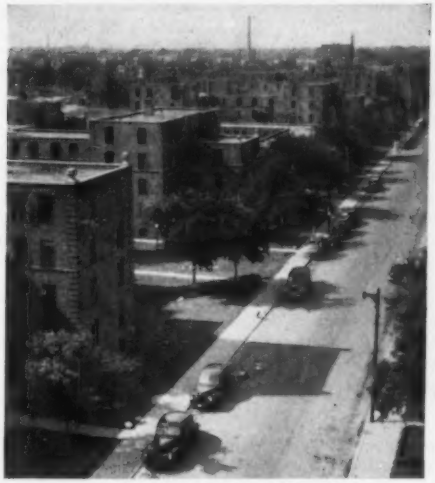
Couplings with Reduced Pressure Drop

HPAC 48—Couplings with streamlined valve design resulting in reduced pressure drop — E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23. A square cut synthetic rubber gasket has been used to effect "perfect sealing." The coupling can be connected or

disconnected with the fingers. When disconnected, it is self sealing on the socket side, but can be made self sealing on both sides with no loss of liquid. It is now available in pipe size diameters from ⅛ to 1 in., and will withstand temperatures from −65 to 350 F, the manufacturer states.

housing projects

Julia C. Lathrop Homes, Chicago, Ill.
Architectural Director: Robert S. Degolyer, Chicago, Ill.



How Dunham Vari-Vac Heating

Cuts fuel costs up to 40%

Your customers can save up to 40% on fuel bills with Dunham Vari-Vac* Differential Heating. Why? Because this high vacuum, precision temperature control system *uses less steam* to heat any building . . . regardless of its size, type, age, or location.

On mild days, for example, Dunham Vari-Vac *expands* smaller quantities of "cool" subatmospheric steam. And on cold days, no matter how rapidly outside temperatures change, Vari-Vac automatically delivers the *exact* amount of heat needed. No more. No less.

Choice of systems. 7 different Vari-Vac systems are available, varying only in the degree of control desired. For complete information, see your Dunham Sales Engineer . . . or write for Bulletin 2101-16.

*Variable Vacuum.

office buildings

Medical-Dental Building, Seattle, Washington
Architect: W. Henry Fey, Seattle, Washington

Send for Free Booklet 2101-2

Tells all you will need to know about this amazing system—how it operates, how it may be fitted exactly to your customers' needs. Write for your copy.

DUNHAM

heating systems and equipment

C. A. DUNHAM COMPANY
400 W. Madison Street, Chicago 6, Illinois
In Canada: C. A. Dunham Co., Ltd., Toronto
In England: C. A. Dunham Co., Ltd., London
Radiation • Unit Heaters • Pumps • Specialties

Instantaneous response to outside weather changes.

Convenience of centralized operation

Automatic compensation for heat loss.

Heat supply and demand perfectly balanced.

EQUIPMENT BRIEFS

VERTICAL HYDRAULIC LIFT for material handling applications—The Lange Lift Co., 102 West Fowler St., Milwaukee 3. It may be placed directly on or bolted to the floor. Lifting power is obtained by means of a foot operated hydraulic pump built into the base of the lift. The lift reduces material handling time by placing metal sheets, bars, pipes, rods etc., into position for fabricating machines, according to the manufacturer.

"Dri-Pure" *WATER-OIL SEPARATOR* for turbine, hydraulic oils or other industrial oil purification problems, where water is a troublesome factor — Honan-Crane Corp., 910 Madison Ave., Lebanon, Ind. It is said by the manufacturer to reduce water content of oil to less than one tenth of one percent.

Automatic *TANG BREAKOFF TOOLS*, for the removal of inserting tangs on helical wire thread inserts — Heli-Coil Corp., Danbury, Conn. Operating on the principle of a spring loaded center punch, fourteen standard models permit removal of tangs of various sizes and lengths.

"Miracle Cold Solder" *MASTIC FILLER MATERIAL* which can be applied with a putty knife, or thinned down and brushed or sprayed on to imperfections and seams in castings and metal fabrications — A. L. Okun (Distributor), 148-26 58th Ave., Flushing, New York. It consists of powdered aluminum in a quick drying, non-soluble liquid vehicle designed to evaporate and leave the deposited aluminum in a smooth surface.

No. 140 "Stik-Wax", *SOLID WAX LUBRICANT IN STICK FORM*, for use in metal sanding, metal sawing, pipe cutting and threading, drilling, etc.—Industrial Products Dept., S. C. Johnson & Son, Inc., Racine, Wis. The product is designed to extend the life of saws, drills and other tools. It can be applied manually or set in a position so that it is automatically applied as the machine operates.

SPARE PARTS KITS FOR MOTOR STARTERS—Westinghouse Electric Corp., 306 Fourth Ave., Pittsburgh 30. Kits contain complete sets of normal wearing parts, including moving contacts, moving contact springs, and stationary contacts. There are six different kits for various types of starters.

W-120 *INDUSTRIAL CHILLING MACHINE*, with capacity of 5 cu ft—Sub-Zero Products Mfg. Div., Deepfreeze Distributing Corp., Cincinnati 29. The equipment will maintain temperatures as low as −120 F, at which temperature it removes 500 Btu per hr, according to the manufacturer. The unit is applicable to smaller heat treating departments, and can be used in lengthening tool life, and saving time in shrink fit assembly work.

LOW TEMPERATURE BRAZING FLUX FOR TITANIUM—Handy & Harman, 82 Fulton St., New York 38. The flux can be used in joining titanium and zirconium, and their alloys. Silver brazing alloys readily wet the titanium which is protected by the flux, the company states.

ADD *Glamour* to your BOILERS AND FURNACES with ATTRACTIVE, DISTINCTIVE

Atlas STEEL CABINETS

Attractive, tailor-made Atlas Cabinets have stream-lined rounded corners, modern hardware and are beautifully finished in oven-baked hammerloid in colors of your choice. There are no bolts or screws and it fits together smoothly and quickly, producing savings in installation costs.

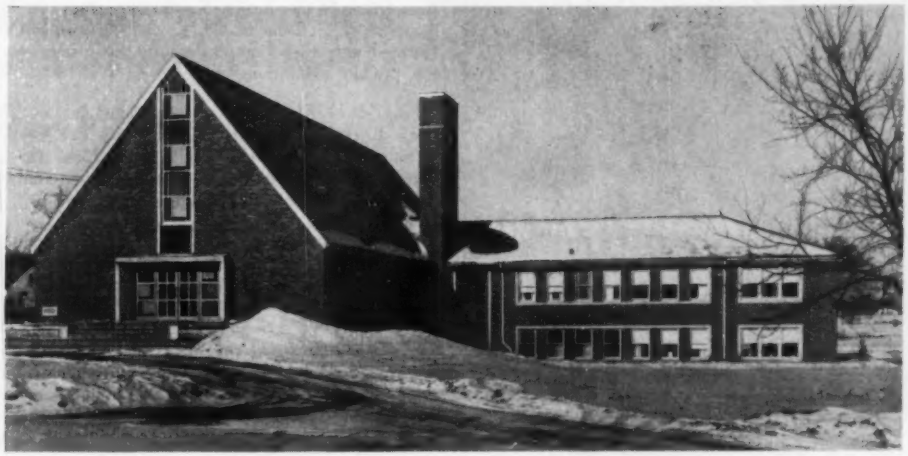
Atlas Cabinets are built to your specifications. They will carry your name and trademark and not that of Atlas. We can produce a full range of all models.

Send Your Specifications for Free Cost Estimates to

Atlas MANUFACTURING CO.

EUSTIS AT ROBBINS ST • ST. PAUL 4, MINN.

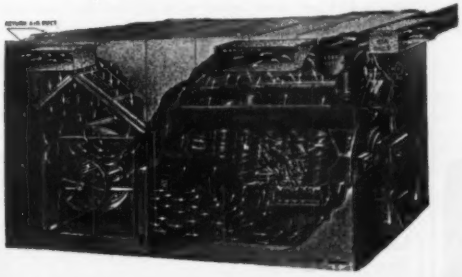
WARM AIR HEATED... by Campbell



Aldersgate Methodist Church, St. Louis Park, Minn. McEnary & Krafft, Architects, Minneapolis. Heated with a single Campbell 8000 Series Heater, installed by C. O. Carlson Heating and Air Conditioning Co., Minneapolis.

• Three Important Advantages

Campbell 8000 Series Heaters offer three big advantages for church heating. They provide the fast heat delivery that is only possible with an extremely efficient warm air unit. They supply abundant heat with remarkable fuel economy. And they provide quick, positive temperature control to meet the varying requirements of the "on and off" operation of churches, schools, theatres, and other public buildings. Available for all fuels in capacities up to 2,160,000 BTUs.



SPECIAL UNITS FOR DRYING & PROCESSING

We build direct oil and gas-fired units up to 14,000,000 BTUs.

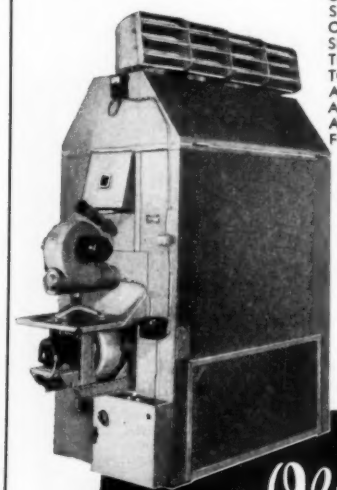
CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

RUGGED AS A PYRAMID
QUIET AS A SPHINX

OLSON HEATERS ARE BUILT FOR A LONG DEPENDABLE FUTURE. HERE IS THE MOST RUGGED HEATER CONSTRUCTION THAT MONEY WILL BUY. A RIGID BASE, FREE FROM VIBRATION, LOW FAN SPEED, OVERSIZE DRIVE, HEAVY SHAFT, LARGE SELF ALIGNING BALL BEARINGS, HEAVY OUTSIDE CASING WITH RADIATION SHIELD AND AMPLE RELIEF AND ACCESS DOORS.

OLSON IS THE ANSWER TO LOW COST EFFICIENT SPACE HEATING. THEY ARE FACTORY ASSEMBLED AND SHIPPED AS A COMPLETE UNIT. AFTER POWER, FUEL AND STOCK CONNECTIONS ARE MADE, IT IS READY TO OPERATE.



Olson

ARTHUR A. OLSON & CO.
Gas, Oil, Coal or Dual Gas and Oil
BROAD ST. - CANFIELD, OHIO

Write for complete information and data sheet, showing horizontal and inverted models, stoker fired and duct units.

WE HEAR THAT . . .

Stockholders of *WORTHINGTON PUMP AND MACHINERY CORP.*, Harrison, N. J., at their annual meeting, re-elected the present board of directors, and voted to change the company's name to *WORTHINGTON CORP.* The change was effected because the company has extended its manufacturing activities into many other fields besides pumps. No corporation policies or practices will be affected by the name change. The company recently held district sales managers' conferences in six plant cities (Wellsville, N. Y.; Buffalo; Holyoke, Mass.; Harrison, N. J.; Dunellen, N. J.; and Succasunna, N. J.). Featured were shop tours, sales problem discussions, and new product exhibitions.

PRAT-DANIEL CORP. recently called in its "Thermbloc" distributor organization for a two day meeting at its South Norwalk, Conn., plant. The purpose was to aid distributors in developing the facility for analyzing customer heating problems and offering solutions.

Principal manufacturers of residential air conditioning equipment reported progress in organizing their trade association operations at a recent meeting at the Hotel Statler, New York. Formed as the *RESIDENTIAL AIR CONDITIONING SECTION, AIR CONDITIONING AND REFRIGERATING MACHINERY ASS'N.*, the group is headed by *J. A. GILBREATH*, Servel, Inc., as chairman, and *A. B. NEWTON*, Acme Industries, Inc., as vice chairman. The group includes in its scope of operations the heat pump as well as conventional forms of residential air conditioning. Statistical and marketing activities are planned, but immediate attention is being given to the formulation of recommended application engineering standards for the installation and operation of year round air conditioning equipment in residences.

THE TRANE CO., La Crosse, Wis., established new records in sales and earnings during 1951. Consolidated net sales were $38,576,000, compared with $27,632,000 in 1950.

It's the golden year for *TOLEDO PIPE THREADING MACHINE CO.*, Toledo, established in 1902, and one of the pioneer manufacturers of pipe threading tools and power pipe machines. The company's story is told in a new brochure now being sent to distributors and jobbers for distribution to their customers.

LEWIS SMITH, field engineer for *C. A. DUNHAM CO.*, Chicago, is now making illustrated talks before local engineering society group and before groups of private engineers and federal public housing officials. He describes several methods of installing and controlling steam heating systems in both private and public housing projects, and in commercial, institutional and industrial buildings. Arrangements can be made for hearing the one hour talk by writing to Mr. Smith at 30 Rockefeller Plaza, New York 20.

Welding equipment manufacturing of *A. O. SMITH CORP.* has been moved into a 27,000 sq ft Milwaukee building, from overcrowded quarters at the company's main Milwaukee works. The building provides space for assembly lines for the company's basic welder models, and

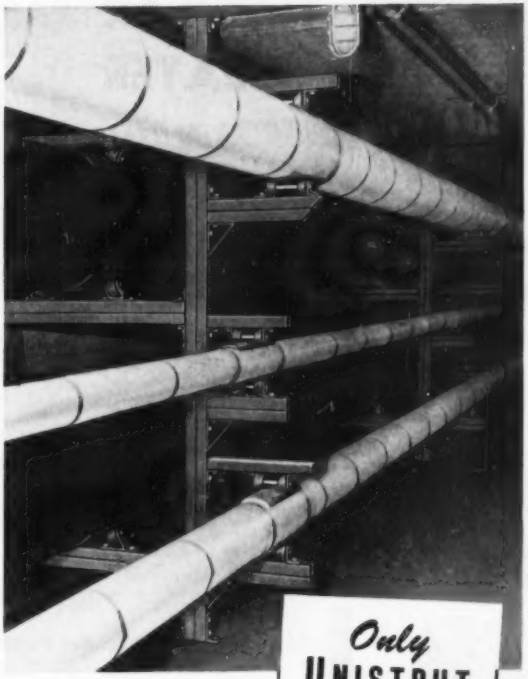
Installs Heavy Piping runs in 4000 ft. tunnel

with versatile UNISTRUT® channel, pipe rollers and concrete inserts

Adjustable UNISTRUT framing assures exact slope or pitch, permits changes and additions at any time. Easy to erect—no special tools or equipment needed.

Photo shows how UNISTRUT framework's great strength easily supports long runs of heavy piping, including bulky 16" chilled water lines, in recent tunnel installation at the University of Houston, Houston, Texas.

W. S. Bellows Construction Corporation, General Contractor; Reg. F. Taylor, Engineer; C. Wallace Plumbing Company, Mechanical Contractor; A. C. Finn, Architect.



Conserves steel • reduces manpower hours • cuts overall costs

The UNISTRUT system of mechanical supports includes steel channel, concrete inserts, roller pipe supports, brackets, clamps and many other standard parts which combine to form the world's most flexible system of support or suspension. It's easy to work with, lasts indefinitely and presents a neat and orderly appearance.

You save time in engineering detailing and eliminate the need for trained erection crews—you get fast, on-the-job framing assembly where adjustments are made and supporting members added as the work progresses. Try it on your next piping job!

Only **UNISTRUT** offers this Spring-held Clamping Nut which ties together both sides of the slotted channel and forms a *Box Section* at points of connection for greater load strength.

UNISTRUT Products are Bonderized

FOR DEFENSE PRODUCTION

Every day the value of UNISTRUT products is being proved by their use in Defense Industries and Armed Services installations where flexibility, and assembly and erection speed count most.

Representatives and Warehouse Stocks in Principal Cities
Consult Your Telephone Directories

U. S. Patent Numbers 2327587 2329815 2345650 2363382 2380379 2405631 2541908 Other Patents Pending

The World's Most Flexible All-Purpose Metal Framing

Write today for your FREE copy of New 78-page Catalog No. 700! Includes countless examples of how to mount, rack, frame, suspend and support all kinds of mechanical and electrical equipment.

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd.
Chicago 7, Ill., Dept. H5

Please send without obligation the items checked below:

☐ Catalog No. 700 ☐ UNISTRUT Sample

Name_____

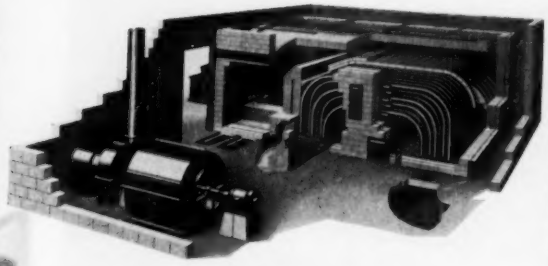
Company_____

Address_____

City_____ Zone_____ State_____

LEE

BRICK-SET TUBULAR HEATER



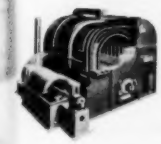
THE BRICK-SET TUBULAR HEATER

Model BST Brick-Set Tubular Heater, Capacity 2,000,000 b.t.u. to 10,000,000 b.t.u. for permanent central heating installations. The finest space heater ever manufactured.

the LEE line . . .

Vertical Tubular Heater

Model VTH *Vertical Tubular Heater*, Capacities 2,000,000 b.t.u. to 6,000,000 b.t.u. Can be used with or without duct distribution. Portable — requires no special foundation. Ideal for pre-heating large volumes of replacement air.



Steel Encased Tubular Heater

Model TSE *Steel Encased Tubular Heater*, Capacities 2,000,000 b.t.u. to 6,000,000 b.t.u. for permanent central heating installations. Ideal for space heating, mine ventilating, coal and ore thawing, drying problems.

"Packaged" Unit Heater

Model HD *"Packaged" Unit Heater*, Heavy duty capacities 300,000 b.t.u. to 2,000,000 b.t.u. Portable. Automatic for oil or gas or combinations. Completely factory assembled and tested.

LEE

SPECIFY LEE

Completely engineered heating.

CORPORATION

1001 TATNALL STREET

WILMINGTON, DELAWARE

houses experimental shops and some sales offices. Space vacated at the main works is being used for expanded welding electrode production.

After ten years of litigation, making one of the longest tax cases on record, the 15 judge U. S. Tax Court has announced a decision vindicating the incentive system of *THE LINCOLN ELECTRIC CO.*, Cleveland. Payments had been questioned by the Commissioner of Internal Revenue.

As part of a program to expand its line of heating equipment, *ILLINOIS IRON & BOLT CO.*, Carpentersville, Ill., has purchased *COMFORT EQUIPMENT CORP.*, Chicago. Under this arrangement, the firm's line includes gas, oil, and coal fired warm air furnaces, gas and oil conversion burners, air circulating systems, and a complete range of stokers up to 1200 lb per hr capacity. Distributorships are still available in some markets.

A new group of stainless steels has been introduced commercially to help in the nickel shortage, according to the 1951 annual report of *ALLEGHENY LUDLUM STEEL CORP.*, Pittsburgh. The new alloys use manganese to replace all or most of the nickel used in chromium-nickel stainless steels. Chromium-manganese alloys, some containing no nickel and some with minor additions of the element, have been introduced as alternatives for applications previously filled by the 18-8 stainless steels. These alloys have been known for many years, but it was not until 1951 that processing and fabricating techniques were developed to permit their production in substantial quantities by the company.

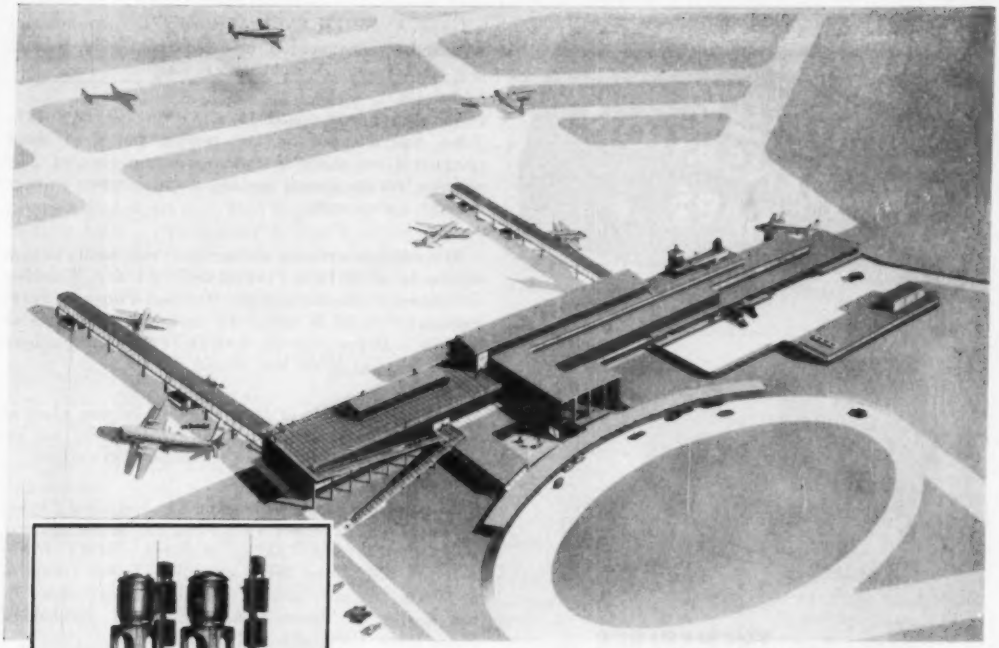
Nineteen regional dealer meetings running until May 22 are being carried on by *WILLIAMS DIV., EUREKA WILLIAMS CORP.*, Bloomington, Ill. *C. S. STACKPOLE* and *E. H. DAVISON*, vice president and general sales manager, respectively, of the division, conduct each of the meetings.

For the fourth time in less than 20 years, *LAWLER AUTOMATIC CONTROLS, INC.*, Mt. Vernon, N. Y., is expanding its plant facilities by 20 percent.

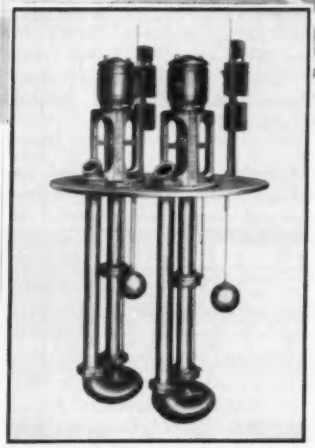
Representatives from all parts of the country recently attended an annual sales meeting at the newly completed factory and office building of *ECLIPSE FUEL ENGINEERING CO.*, Rockford, Ill.

FRESH'ND-AIRE CO., division of *CORY CORP.*, Chicago, is offering a choice of color combinations to every purchaser of its room air conditioner during a forthcoming Spring promotion. The offer, made on a regional basis through distributors, enables the purchaser to obtain, at no extra cost, a conditioner individually painted to match a room's decor.

A 1.5 hp gasoline-engine-driven oil burner with a capacity range of 0.8 to 2.5 gph is being manufactured for the government by *WAYNE HOME EQUIPMENT CO., INC.*, Fort Wayne, Ind. The engine drives the fuel pump and fan, and the engine-driven magneto generator, assembled as part of the unit, supplies the power needed for ignition.



Carroll, Grisdale & Van Alen, Architects
A. E. D'Ambly, Structural Engineer — L. E. Winter & Company, Contractor



In selecting the sewage and sump pumps for Philadelphia's Airport Terminal Chicago Non-Clog Pumps were specified. The large volume of traffic with heavy peak loads at arrival and departure time made it essential that reliable, heavy duty pumps be used. The Chicago Non-Clog with a background of 43 years of rugged dependable service, was the logical choice. 28 pumps, in basins of 14 duplex sets, pump the sewage and bilge from this new and modern airport terminal.

To assure efficient and trouble-free service Engineers for Philadelphia's International Airport choose CHICAGO NON-CLOG PUMPS

—14 DUPLEX SETS—

Philadelphia's great new international airport is one of the finest in the world. The modern terminal building incorporates the latest in design and lay-out for easy and efficient handling of passenger traffic.

In planning the structure, the architects wisely provided for future growth. At the present rate of expansion it is expected that by 1960 about 613,000 passengers per year will use the terminal. Both at present and with this expected volume of traffic, Philadelphia's airport will rank among the first 20 in the country, both as to number of planes and number of passengers using the airport. Carroll, Grisdale & Van Alen, Architects. A. E. D'Ambly, Structural Engineer. L. E. Winter & Company, Contractor.

CHICAGO INDUSTRIAL PUMPS

CHICAGO PUMP COMPANY

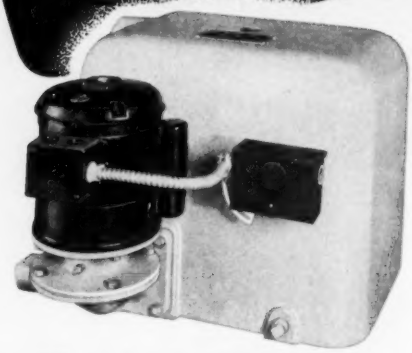
BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

Sterlco
CONDENSATION PUMPS



Proving THEMSELVES in INSTALLATION after INSTALLATION

Time after time, Sterlco Condensation Pumps have proven they can do a better job — and there are many reasons why. Take, for instance, the Sterlco 4200 Series Condensation Pump. It is designed to do one job, and do it outstandingly well. Rated conservatively, the 4200 can actually safely deliver its full rated output continuously for long periods — and its many exclusive features cannot be found in much higher priced pumps. Yes, it's no wonder Sterlco *always* does a better job.

- **LONG WEARING Carbon-Type ROTARY SEAL**
- **LARGE CAPACITY TANK**
- **COMPACT, NEAT APPEARANCE**
- **EASY ACCESSIBILITY OF PARTS**

New Sterlco 4100 Series for jobs where steel tank is preferred. Same features as 4200.

Mail Now

All STERLCO products are distributed through leading heating and plumbing wholesalers.

STERLING, INC.

3732 N. HOLTON STREET • MILWAUKEE 12, WIS.

GENTLEMEN: Please send me complete information on Sterlco Condensation Pumps.

Name.....

Firm.....

Address.....

City.....Zone.....State.....

Sterlco PRODUCTS

Condensation and vacuum pumps

Heating specialties

Temperature controls

The *A. V. SMITH ENGINEERING CO.*, corrosion consultant, has announced a new location in the Coulter Bldg., 121 Coulter Ave., Ardmore, Pa.

An open house staged by *COOPER SUPPLY CO.*, Tulsa, was attended by 150 heating and sheet metal contractors, two thirds of whom were out-of-towners. The occasion was the formal opening of the company's newly remodeled showroom.

At opening ceremonies of the Santa Ana., Calif., branch warehouse of *HERCO PIPE & SUPPLY CO.*, Chamber of Commerce officials, and the Merchant Plumbers Ass'n. welcomed *OSCAR WARSCHAW* and other executives of the firm to Orange County. *LES DEFFENDALL* has been named manager of the new branch.

With 20,000 sq ft of floor space in its new plant at Addison, Ill., west of Chicago, *THE PAINE CO.* has increased its estimated capacity by almost 30 percent.

To supplement material contained in *Simplified Physics of Vapor and Thermal Insulation*, his recent manual, *ALEXANDER SCHWARTZ*, president, *INFRA INSULATION, INC.*, New York, is lecturing before groups of architects, students, housing officials and engineers. He has spoken at Massachusetts Institute of Technology, Notre Dame University, and other schools.

Development and testing of combustion and process control systems and instruments will be a major function of the new research and development laboratory at the Orrville, Ohio, plant of *HAGAN CORP.*, Pittsburgh.

KENCO, INC., Lorain, Ohio, manufacturer of sump and bilge pumps and an automatic switch, has established 15 key field service centers in the eastern half of the country.

A silver trophy for top sales performance in 1951 was presented to *T. W. DRENNEN*, manager, New York branch, *FAIRBANKS MORSE & CO.*, Chicago, at a special dinner in the Waldorf-Astoria Hotel, which was attended by about 150 people.

KAISER ALUMINUM & CHEMICAL CORP., Oakland, Calif., has raised its primary aluminum production goal beyond the 800,000,000 lb a year mark by authorizing immediate construction of additional facilities at its Tacoma, Wash., reduction plant.

The second 50,000,000 lb a year potline at the Chalmette (New Orleans) aluminum plant was completed 85 days after the first unit began production. Capacity of the facility is now 100,000,000 lb a year, one fourth of the intended final annual capacity. The company will soon open up a mill, in Nevada, for processing fluorspar, a mineral needed in the production of aluminum metal.

KAISER STEEL CORP. has announced a $65,000,000 expansion program designed to increase its pig iron output by 50 percent, and raise steel ingot production by more than 11 percent. It will be carried out entirely with private financing, and will involve a number of additional facilities at the Fontana, Calif., plant.

WHO'S WHAT

JOHNSON SERVICE CO., Milwaukee, has appointed *KENNETH A. WRIGHT*, Cincinnati branch manager, as vice president and central district manager. He succeeds *OSCAR G. WARD*, who had been scheduled for retirement, but who died April 12. Mr. Wright's appointment was effective April 1. The central district, with headquarters in Chicago, is one of the company's three major administrative divisions, and comprises some 30 branch offices in the area extending from Pittsburgh to Omaha and south to the Gulf of Mexico.

JOSEPH D. McMANUS, chief engineer, has been named vice president in charge of engineering, *WALWORTH CO.*, New York. *HELMUTH STRAUSS*, assistant vice president, sales, is now vice president in charge of western sales, and *FREDERICK M. JACKSON*, assistant vice president, sales, has been named vice president in charge of eastern sales.

JUSTICE LOCKWOOD, formerly manager of the Buffalo branch of *THE AMERICAN BRASS CO.*, has been appointed vice president in charge of sales for the entire company, with headquarters at the main office in Waterbury, Conn. The post has been vacant since the retirement of *ELTON S. WAYLAND* in January, 1950. Mr. Lockwood joined the company in 1929.

The new sales manager, Boiler Div., *CLEAVER-BROOKS CO.*, Milwaukee, is *HAROLD F. HOLTZ*, formerly advertising and marketing manager for the company. He succeeds *R. J. TUTSCH*, who resigned his position, forming a new manufacturing agency in partnership with *T. P. DYKE* to handle the company's equipment in the Milwaukee area and the nine southeastern counties in Wisconsin.

JOHN E. DUBE, president, Alco Valve Co., was elected president of the *REFRIGERATION EQUIPMENT MANUFACTURERS ASS'N.* at its recent annual board of directors meeting. He succeeds *W. A. SIEGFRIED*, president, Superior Valve & Fittings Co. *L. C. McKESSON*, vice president in charge of sales, Ansul Chemical Co., was elected vice president. Also elected were *LUD EMDE*, president, Temprite Products Corp., as treasurer; and *JAMES EMMETT, JR.*, vice president, James P. Marsh Corp., as secretary.

L. J. MUELLER FURNACE CO., Milwaukee, has appointed *HAROLD P. MUELLER, JR.*, as assistant sales manager, to coordinate sales and administrative activities between the home office and sales representatives throughout the country. Previously, he was company sales representative in the Milwaukee territory.

Officers elected for the ensuing year at the recent 13th annual meeting of the *PROPELLER FAN MANUFACTURERS' ASS'N.* are: *E. J. STONE*, Ilg Electric Ventilating Co., president; *P. T. FINCH*, Hunter Fan & Ventilating Co., Inc., vice president; and *L. O. MONROE*, secretary-treasurer.

It's the **LOW DOWN** DIRT trapped by
WILSON'S HAIR FILTERS
that GUARANTEES LONGER LIFE

In Wilson *Hair* Filters the entire dust-holding capacity is completely utilized. This means, *no surface dust stopping only*, but Full-Depth Dust Trapping at its best . . . and many extra months of filter life.

The *reasons* are so simple:

1. The hair media in Wilson *Hair* Filters act in the same manner as Mother Nature's proven way of filtering the air you breathe. It's the *hair* that cleans the air . . . more easily, more effectively, more economically.
2. The multi-directional distribution of the hair in Wilson *Hair* Filters literally invites all dust and dirt to come in and be trapped throughout the entire filter interior.
3. Most brands of air filters require oiling on their inlet surfaces. This stops dust prematurely, loads up the incoming air side and materially shortens filter life.

Wilson Hair Filters are not oiled on the inlet side. Instead, they receive an even distribution of mineral oil *on their outlet surface*, which:

(a) augments the already amazing ability of the hair itself, to catch and hold dust, and—
(b) builds an impregnable barrier which halts dust and dirt after reaching the furthermost practicable penetration point.

WILSON & CO., INC.
(Air Filter Division) 4100 South Ashland Ave., Chicago 9, Ill.

Wilson Hair Filters are another quality product of Wilson & Co., world-famous for meat products, sports equipment, pharmaceuticals, hair products, etc.

The famous Edgeseal, the original *Hair* Filter with the patented self-sealing edge.

The popular Honeycomb, the dressed up *Hair* Filter that is so easy to handle.

Save delay. Save dollars. Save doubt. Send for FREE sample with details and prices.

INDOOR COMFORT
WILSON'S HAIR FILTER
WILSON & CO

ALSTROM

A Dependable Source for CUSTOM BUILT HEAT EXCHANGERS

guarantees top performance in...

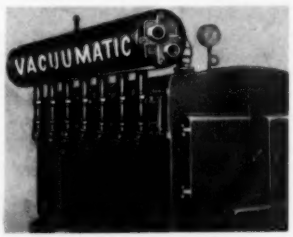
INDUSTRIAL • COMMERCIAL INSTITUTIONAL AND PUBLIC BUILDING INSTALLATIONS

Experienced Alstrom Engineering is your assurance of properly designed and constructed heating equipment—*in stock or tailor made to your specifications.* Alstrom Engineers can also provide you with expert on-the-job guidance.

APPROVED BY THE NEW YORK CITY BOARD OF STANDARDS AND APPEALS NO. 425-51-S.A.

"SAFE GUARD" OIL PREHEATER

A special purpose industrial heat exchanger which is completely "fuel-proof" and really heats oil, this ingenious "double-transfer" oil preheater contains a capillary transfer chamber between oil tubes and boiler water which ends contaminating of boilers and heating systems. The unit positively isolates leaking oil, yet effects rapid, efficient heat exchange. Full range of sizes.



***Vacuumatic Instantaneous Heater**

"The World's Fastest Water Heater"

*Reg. U. S. Pat. Off.

Ideal for all steam heating boilers, this famous development of The Alstrom Corporation has been proven superior in thousands of installations. Write for booklet "The Vacuumatic Story"

SUBMERGED COILS . . . for every purpose

Send for detailed catalog No. 30

Manufacturers of: INDUSTRIAL HEAT EXCHANGERS • TANKLESS GENERATORS • STEAM HEATED INSTANTANEOUS WATER HEATERS • SUBMERGED HEATERS FOR COMMERCIAL STEEL BOILERS • HEAT RECLAIMERS

THE ALSTROM CORPORATION
790 East 176 St. • New York 60, N. Y.

The new director of public relations for *CARRIER CORP.*, Syracuse, is *JOHN K. BARNES, JR.*, who fills the post left vacant by the death of *JOHN F. CHESTER.* Mr. Barnes, previously with Lever Brothers Co., New York, has had wide experience in the field of news reporting and public relations. *JOHN M. RACHAL* is now manager of the company's International Div. Formerly divisional sales manager, he succeeds *HEMAN GREENWOOD*, for eight years vice president in charge of international business. Mr. Greenwood has retired, but will continue to serve in a consulting capacity.

E. C. WEBB is now vice president in charge of production and engineering for *IRON FIREMAN MFG. CO.*, Cleveland. With the company for 22 years, he has most recently been vice president in charge of research and development engineering.

LYNCH CORP., Anderson, Ind., has elected *ERNEST M. OSWALT* as a director. As one of its first stockholders, he has been familiar with the operation of the corporation since its inception. Mr. Oswalt was the founder of the Campana Corp. of Batavia, Ill., and Toronto.

W. A. MATHESON, JR., has been appointed vice president in charge of sales, *INTERNATIONAL HEATER CO.*, Utica, to direct the sale of furnaces and boilers. Formerly he was with Perfex Corp.

The new manager of manufacturing in all plants of the *RHEEM MFG. CO.*, New York, is *HARRY W. FILLER*, who has been with the company for 18 years, most recently as divisional manager of plants in Bayonne and Linden, N. J.

HARRY M. FRECKER is now manager of commodity sales, Mechanical Goods Div., *UNITED STATES RUBBER CO.*, New York. He joined the company in 1922.

R. DAIL MOORE has been named marketing manager, Room Cooler Dept., *GENERAL ELECTRIC CO.* The department recently was transferred from the Air Conditioning Div., Bloomfield, N. J., to the Major Appliance Div., Louisville, Ky. Mr. Moore has been coordinator of the jet engine parts department, Major Appliance Div.

ANTHONY ADAMIC was recently elected president of *MERCURY PIPING CO., INC.*, Boston. The company's new plant is located at Building 21, Atlantic Properties, Endicott St., Norwood, Mass.

THOMAS H. FORD has been named engineering manager, room air conditioning activities, *RCA VICTOR DIV., RADIO CORP. OF AMERICA*, Camden, N. J. He has been with the Vilter Mfg. Co.

L. R. FOOTE has been promoted to the post of national sales representative for industrial combustion equipment by *BRYANT HEATER DIV., AFFILIATED GAS EQUIPMENT, INC.*, Cleveland. Previously eastern sales representative, he will maintain his New York area office.

CURTIS MFG. CO., St. Louis, has appointed *ALEX G. PAPPAS* as advertising manager. He was formerly assistant to the advertising manager, Roberts, Johnson and Rand Shoe Co.

JOHN F. BRIGGS, JR., has been appointed adjunct professor of mechanical engineering, *NEW YORK UNIVERSITY COLLEGE OF ENGINEERING*. His teaching assignment will be in addition to his post as application engineer, air conditioning and refrigeration, *CARRIER CORP.*, Syracuse.

WENDELL F. McKOWN, JR., is now works manager for *THE COOPER ALLOY FOUNDRY CO.*, Hillside, N. J. For the past 10 years he has been purchasing agent for Pratt & Whitney Aircraft Div., United Aircraft Corp.

ALLEN LATHAM, JR., has been elected a vice president of *ARTHUR D. LITTLE, INC.*, consulting research and engineering firm of Cambridge, Mass. He will retain his post as technical director of the Mechanical Div., in addition to having responsibility for overall operation. *LEROY F. MAREK* has been named to the board of directors, and will have charge of technical operations of the company.

I. MELVILLE STEIN, executive vice president of *LEEDS & NORTHRUP CO.*, Philadelphia, has been elevated to the grade of Fellow by the *AMERICAN SOCIETY OF MECHANICAL ENGINEERS*. The certificate of award was presented to him at a recent monthly meeting of the Philadelphia chapter.

J. V. O'CONNOR has been named chief of the Brass Mill Section, Copper Div., *NPA*. He succeeds *DAVID T. MARVEL*, recently named assistant deputy administrator of NPA's metals and minerals bureau. Mr. O'Connor has been on leave of absence from C. G. Hussey & Co., since July 1951.

J. D. GREENSWARD has been appointed manager of a newly organized apparatus department at *ALLIS-CHALMERS MFG. CO.*, Milwaukee. He continues as general manager of the company's Norwood Works.

EDWIN M. MILLER is now plant superintendent, Machine Div., *THE LINCOLN ELECTRIC CO.*, Cleveland. He has been with the company for 29 years. His appointment follows the resignation of *H. F. KNEEN*, manufacturing vice president.

RUSSELL H. RANDOLPH has been appointed general sales director, *FAGEOL HEAT MACHINE CO.*, Detroit. For the past 15 years he has been regional sales representative of The Boss Mfg. Co.

JOHN DUNCAN, JR., has been named to the newly created post of director of trade relations, *KAYLO DIV., OWENS-ILLINOIS GLASS CO.*, Toledo. With the company for 19 years in various sales, purchasing and administrative capacities, he now will act as a special representative contacting major firms.

These Illustrations Show One of the Important Reasons Why

THERM-O-TILE

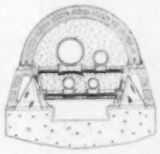
Reg. U. S. Pat. Off.

UNDERGROUND STEAM CONDUIT

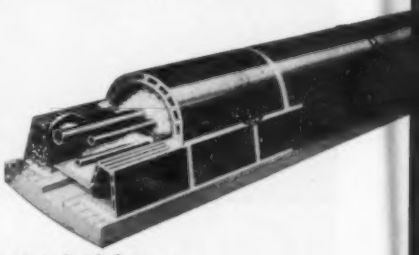
is so commonly specified by leading heating and ventilating engineers and contractors. They know how well Therm-O-Tile meets situations and requirements. Let us say, for example, that it is decided to use

FILLER TYPE INSULATION

The illustration below shows how Therm-O-Tile takes care of that. And be sure to note the *additional* insulation around the filler — the insulation inherent in Therm-O-Tile's air-celled exterior.



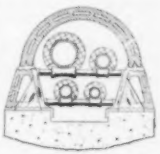
Showing the Use of Filler Type Insulation.



Or, let us say that it is decided to use

SECTIONAL PIPE COVERING

The illustration below shows Therm-O-Tile's way. And, again, the user gets the additional air-celled exterior insulation.



Showing the Use of Sectional Pipe Covering.

BULLETIN 511 EXPLAINS. *This bulletin, just recently published, gives complete data concerning Therm-O-Tile and shows many of the prominent users including First Prize Glen Oaks Village, New York City, a $30,000,000 project. Ask for a copy.*

OUR ENGINEERS WILL HELP. *You can depend on Therm-O-Tile Engineers for recommendations, estimates of cost, and complete specifications for the conduit and insulation on any underground pipe line project. Give us your requirements.*

JOHNS-MANVILLE. *Therm-O-Tile is represented by Johns-Manville Technical Service Units in all principal cities.*

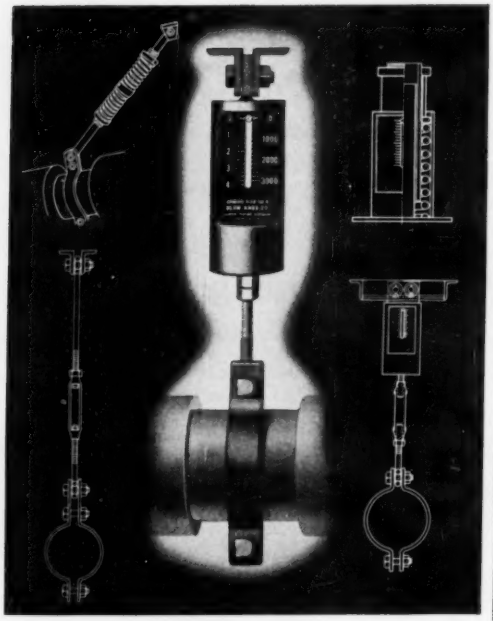
H. W. PORTER & CO., INC.

822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.

BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

Insulation Engineers & Contractors

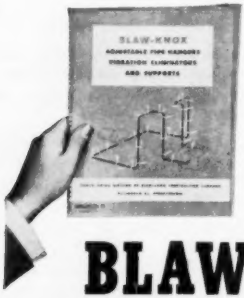


Do you know about

BLAW-KNOX PIPE HANGERS?

The Blaw-Knox line of *standard* Pipe Hangers and Supports meets the requirements of any piping system . . . eliminates the need to design special Supports for the job. Designers can proceed directly from hanger analysis to selection and application of hangers.

Catalog No. 51 contains a special Technical Section to help you quickly determine such factors as thermal movement, weight of piping materials and hanger location. If you are looking for ways to speed up hanger design, write for Catalog No. 51 on your company letterhead. No obligation.



POWER PIPING DIVISION

BLAW-KNOX CONSTRUCTION CO. PITTSBURGH 33, PA.

BLAW-KNOX

PIONEERS IN THE DEVELOPMENT OF FUNCTIONAL HANGERS VIBRATION ELIMINATORS

JOHN C. DAVIDSON is now assistant manager of application engineering, *AIRTEMP DIV., CHRYSLER CORP.*, Dayton, Ohio. He joined the division in 1947 as a field engineer, a post he has held until his present appointment.

The new manager, Wholesale Distributing Div., *MUELLER BRASS CO.*, Port Huron, Mich., is *ROBERT L. GIBBS*, formerly manager of field sales personnel. *TYLER RIGGIN*, whom he succeeds, was recently appointed executive vice president of *VALLEY METAL PRODUCTS CO.*, Plainwell, Mich., a newly acquired subsidiary.

FIBER GLASS DIV., PITTSBURGH PLATE GLASS CO., Pittsburgh, has appointed *G. DONALD CAMPBELL* as superintendent, and *JOHN A. McMILLAN* as plant engineer for its Shelbyville, Ind., manufacturing plant. Conversion of the recently purchased plant to fiber glass production will soon be underway. Mr. Campbell has been assistant superintendent at the Clarksburg, W. Va., plant. Mr. McMillan has for the past five years been plant engineer for Duplate Canada, Ltd.

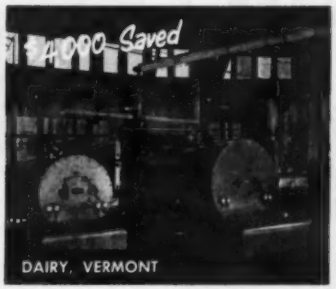
ROBERT A. SLENES has been named export sales manager for *DIAMOND IRON WORKS, INC.*, Minneapolis, and its *MAHR MFG. CO. DIV.* He has served as assistant military attache at the U. S. embassies in Portugal and Mexico, and as assistant export manager for Ramey, Scott and Co., Cleveland.

A. L. JONES is the new manager, Water Treating Div., *WORTHINGTON CORP.*, Harrison, N. J. Formerly manager of the sale of water treating and of the deaerator section, Steam Power Div., he will now be in charge of sales, engineering, production and service of water treating equipment. *DONALD W. BEDELL* has been named industrial relations assistant to *L. C. RICKETTS*, vice president in charge of manufacturing. Formerly a staff writer on a newsletter published by the Biddle Purchasing Co., New York, he will edit a newsletter for executives and assist managers on communications to employees and communications surveys.

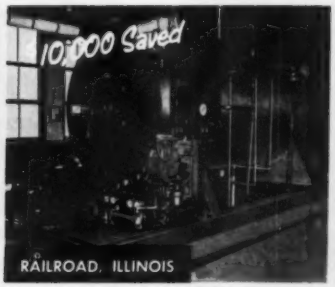
MANNING, MAXWELL & MOORE, INC., Stratford, Conn., has appointed *MORRIS S. PALMER* as manager of field sales, and *RAYMOND F. ATTNER* as valves product manager, succeeding Mr. Palmer. Mr. Attner was distributor manager of valves. His headquarters will be in Watertown, Mass., and Mr. Palmer will be located in the Stratford, Conn., plant.

MATTHEW E. DUNLAP, research engineer at the *U. S. FOREST PRODUCTS LABORATORY*, Madison, Wis., has retired after more than 35 years on the staff. He plans to divide his time between management of his farms and a private consulting service. During his service, Mr. Dunlap has done research in glues, fireproofing, plywood development, and moisture control in modern houses. He set up a heat transfer laboratory to study insulation, moisture vapor barriers, etc.

YOU TOO, CAN SAVE THOUSANDS OF



DOLLARS ANNUALLY ON STEAM COSTS

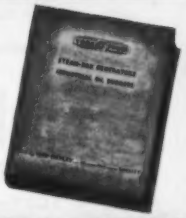


WITH MODERN STEAM-PAK *GENERATORS

* Steam-Pak Generators are self-contained high or low pressure steam or hot water heaters ranging from 15 to 250 hp. in capacity. Steam-Paks are fired with oil (No. 3, 5 or 6), gas, or a combination of gas and oil. They are easily installed, fully automatic, and efficient.

GET THIS BOOK TODAY!

Steam-Pak's 208-page Architects' Manual is the only complete reference on steam generators. Contains specifications, hook-ups, wiring and piping diagrams, operating charts. Request Manual 101-C today on your letterhead.



Steam-Pak Generators — A Product of York-Shipley, Inc., York, Pa.

ALDRICH

Solves Your Hot Water Problems with

On-the-Spot Supply

ALDRICH

High Delivery

HOT WATER HEATERS

7 MODELS

93 to 850 GPH

Oil Fired — Gas Fired

On-the-Spot Supply for

Factories	**Schools**
Stores	**Institutions**
Restaurants	**Hospitals**
Terminals	**Additions**

SAVE
Costly Piping
Installation Time
Temperature Loss

Need hot water in remote locations? Wash-up rooms? New additions? Peak periods? An Aldrich High-Delivery hot water heater supplies from 93 to 850 gallons an hour. Heating is direct, saves slow storage. And you save long piping runs, complex installations. Aldrich heaters are designed for low-cost efficiency, from either oil or gas. They need little space, can be put in existing buildings without major alterations. . . . save space on new construction.

Write today for full specifications.

ALDRICH COMPANY

ALDRICH HEAT-PAK PRODUCTS

105 East Williams Street, Wyoming, Illinois

A subsidiary of Breeze Corporations, Inc.

ANOTHER BREEZE MARK PRODUCT

. . . IN THE TERRITORIES

For *SPORLAN VALVE CO.*, St. Louis—*ROBERT L. VANDIVER*, field sales engineer for newly established territory comprising western New York and western Pennsylvania, sections of which were formerly in Cleveland and New York territories. His headquarters will be in Syracuse. *JACK E. DANNELS*, whose headquarters were in Cleveland, is now in Cincinnati, at 8705 Monsanto Drive. *WILL REICHENBACH*, who formerly covered parts of upper New York, now concentrates activities in metropolitan New York, the Hudson River valley area, and the state of New Jersey. Headquarters remain at 22 W. First St., Mt. Vernon, N. Y.

For *MIDWEST PIPING & SUPPLY CO., INC.*, St. Louis—eastern division offices moved to 50 Church St., New York 7, providing twice as much space as before.

For *UNITED STATES AIR CONDITIONING CORP.*, Minneapolis—window type room air conditioners and self-contained store coolers to be distributed by the *HAJOCA CORP.* in nine middle Atlantic and southern states. Hajoca operates 33 branches in these states (New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, Tennessee, Georgia and Florida). Sales will be under the direction of *R. B. DAVIS*, manager of Hajoca's refrigeration supply division. Other new distributors for this equipment are *THE BODWELL CO., INC.*, 2327-33 North 7th St., Harrisburg, Pa., covering central Pennsylvania, and *PROIE BROTHERS, INC.*, 840 Pennsylvania Ave., Pittsburgh, for western Pennsylvania and northern West Virginia.

THE B. E. CULBERTSON CO., Cincinnati, will represent the company's complete line of heating, ventilating and air conditioning equipment in southern Ohio and the Kentucky area. In addition, eight new direct factory dealers will handle packaged air conditioners. They are: *CHEROKEE HEATING CO.*, Atlanta; *CY BELL HEATING & AIR CONDITIONING CO.*, Gainesville, Ga.; *DeSOTO REFRIGERATION CO.*, Mansfield, La.; *GENERAL REFRIGERATION CO.*, East Alton, Ill.; *G-M REFRIGERATION CO.*, Fall River, Mass.; *MARION DAVIS ELECTRIC AND PLUMBING CO.*, Easley, S. C.; *HENRY NEWHOUSE*, Clarksville, Tenn., and *QUARLES REFRIGERATION CO.*, Savannah, Ga.

For *CHASE BRASS & COPPER CO.*, Waterbury, Conn.—*CHARLES L. MOSELEY*, for the past 13 years manager of the Rochester, N. Y., office, now transferred to Waterbury as district manager of that territory, including supervision of the branch warehouse. He succeeds *WOOSTER CANFIELD* who will retire about Sept. 1.

For *ENGINEERING AND EQUIPMENT CO.*, Albany, Ga. (wholesale distributor)—*THOMAS E. YOUNG*, formerly vice president and manager of the heating department, now vice president and general manager.

For *RCA VICTOR DIV., RADIO CORP. OF AMERICA—ROWLAND B. GREENWAY*, field sales represen-

BUYING

VENTILATORS?

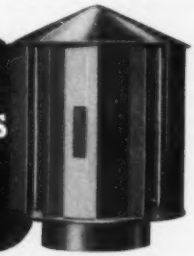
GET THE **FACTS** FIRST...

Ask for CERTIFIED Ratings... It's the only way you can be sure ventilator performance will measure up to the ratings claimed for it.

Ask for Ratings Based on VARIABLE Wind Conditions... if you want a ventilator that performs efficiently under *all* wind conditions. Ratings of most ventilators are based on *horizontal* wind tests only, or tests made at favorable angles. Many ventilators down-draft at other angles.

Breidert Air-X-Hausters

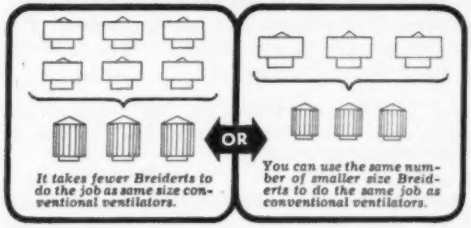
PROVIDE SAFE, SURE VENTILATION NO MATTER WHICH WAY THE WIND BLOWS...



Patent No. 2269428

Certified tests show that the actual capacities of Breidert Air-X-Hausters are greater than published ratings (barring interior negative pressures). Stationary, no moving parts, nothing to jam or get out of order. *The Breidert is the pioneer ventilator* to publish certified ratings based on tests* made with wind blowing in all directions.

The Breidert Delivers Better Results at Minimum Cost


OR
It takes fewer Breiderts to do the job as same size conventional ventilators.
You can use the same number of smaller size Breiderts to do the same job as conventional ventilators.

Get *all* the facts! Write today for complete Engineering Data Book, including certified capacity ratings. Address Dept. A.

✔ Every businessman should read "Plain Facts and Simple Figures," written by G. C. Breidert. This thought-provoking article pertains to the problems of every American businessman. The first twenty lines will open your eyes! Write for a free copy.

THE G. C. BREIDERT CO.

3129 San Fernando Road, Los Angeles 65, Calif.
Representatives in principal cities throughout the U. S.

*By Pittsburgh Testing Laboratories

HERE'S YOUR ANSWER For Good CORROSION PROOF CONSTRUCTION

Steel Pipe and Fittings Lined with Neoprene type Sheet Rubber

- **RUBBER**
- **LEAD**
- **PLASTIC**

. . . **YOU SAVE** time and money when you specify *HEIL* for your lined pipe and duct requirements. Fabrication and complete lining facilties under one responsibility offers you equipment faster and more economical.

. . . **LONGER LIFE** with less maintenance cost is assured by expert workmanship and unbiased selection of the best lining material for your specific requirement.

Write for illustrated literature

Representatives in all Principal Cities

Heil Process Equipment Corp.

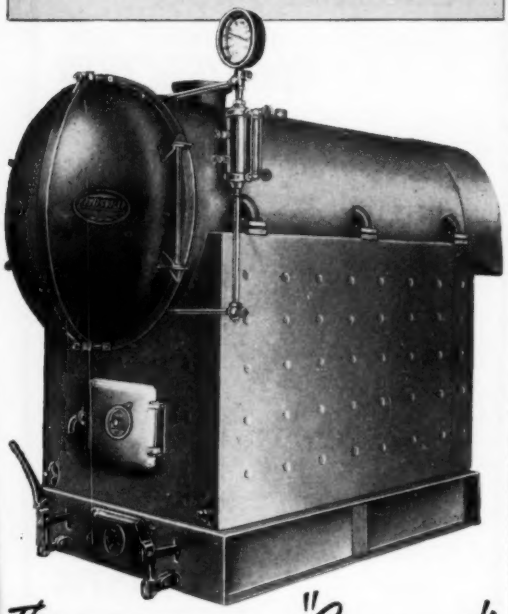
12901 Elmwood Ave., Cleveland 11, Ohio

Sales Offices: 152 West 42nd St., New York, N. Y.
400 West Madison Ave., Chicago, Ill.

Your All-Around Boiler

FOR ALL FUELS

AND ALL TYPES OF FIRING



The **TITUSVILLE** *"Compact"*

Steel Heating Boiler

Economical use of oil, gas or coal is an outstanding advantage of the Titusville "Compact" Boiler. An exceptionally large combustion chamber runs the full length of the shell, providing ample space and time for complete burning—yet the boiler takes up less room than any other type. ● Extensive automatic welding of seams and joints, positive circulation, steel flue-door assemblies and other refinements assure trouble-free service.

Write for Bulletin B-3000-B.

THE TITUSVILLE IRON WORKS COMPANY

A division of Struthers Wells

Representatives in Principal Cities

TITUSVILLE, PENNSYLVANIA

tative for room air conditioners in the east central region. Headquarters are in Cleveland. Major market centers in the region include Cincinnati, Detroit, Saginaw (Mich.), and Pittsburgh.

For *REYNOLDS METALS CO.*, Louisville, Ky.—three new distributors. To handle the general line of aluminum products: *VINSON SUPPLY CO.*, 3331 Haggar Dr., Dallas, for Dallas, Odessa, Tex., and Tulsa; and *VORY'S BROS., INC.*, 65 E. Goodale St., Columbus, for central and southern Ohio, western West Virginia and eastern Kentucky. To handle ingot products only: *C. S. AVRIL SMELTING CORP.*, Este Ave. & B&O Railroad, Cincinnati, for all of Kentucky, south central Ohio, southeastern Indiana, western West Virginia, and northern Tennessee.

For *MITCHELL MFG. CO.*, Chicago—several new distributors to handle the 1952 line of window type room air conditioners: *RICHARDS AND CONOVER*, Fifth and Wyandotte, Kansas City, Mo.; *E. H. ROLF COAL & SUPPLY CO.*, 1702 Fairfield Ave., Fort Wayne; *B. M. TOWER CO., INC.*, 366 Fairfield Ave., Bridgeport 3, Conn.; *TRACEY & CO., INC.*, 80 West Exchange St., Providence; *TRI-STATE DISTRIBUTORS, INC.*, Colonie & Montgomery Sts., Albany 4; and *TURNER DISTRIBUTING CO.*, 308 S. Campbell St., Springfield, Mo.

For *ACME INDUSTRIES, INC.*, Jackson, Mich.—two new representatives. To handle the complete line of air conditioning and refrigeration equipment, *LAURENCE TRANT AND CO.*, Norfolk, Va., for the state of Virginia with the exception of Fairfax county and the city or Arlington; to handle the products of the Contractor and Flow-Cold divisions, *AIRES CO.*, 101 N. 33rd St., Philadelphia, for the western Pennsylvania region. In addition, the company has opened a new and larger office in Chicago, at 230 East Ohio St.

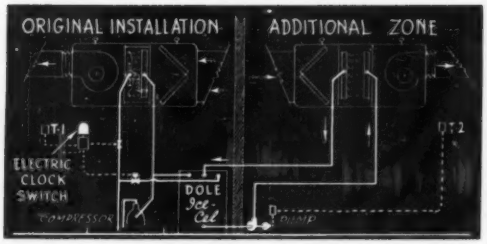
For *VIKING AIR CONDITIONING CORP.*, Cleveland —*WOODY FAISON*, representative in southern Ohio, Kentucky, West Virginia, and southern Indiana. Formerly, he was division sales manager of major appliances for the Western Auto Supply Co.

For *UNISTRUT PRODUCTS CO.*, Chicago—new western district office, 785 Market St., San Francisco. *D. A. BROWNLIE* is in charge.

For *LYNCH CORP.*, Anderson, Ind.—two new district offices. Midwestern office, Suite 428, 506 S. Wabash Ave., Chicago, under management of *B. D. BERK*, formerly midwestern sales manager, Par Div., to be assisted by *F. G. LENHART*. Southern office, 1036 Peachtree St., Atlanta, under management of *B. J. SCHOLL*, former Par Div. district manager, to be assisted by *R. W. GRAF*.

For *BALDWIN-HILL CO.*, Trenton, N.J. — *P. A. BELL*, district manager, industrial sales, New England area. Headquarters will be the sales office, 500 Fifth Ave., New York.

For *BAKER REFRIGERATION CORP.*, South Windham, Me. — *FRANK QUINN*, new district manager,



COOL *Additional Zones with the Same Compressor using* DOLE *Ice-Cels*

When additional space in the same or adjacent buildings is to be air conditioned, DOLE Ice-Cels can do the job usually without the purchase of another compressor, thereby saving the cost of a machine.

The DOLE Ice-Cel is connected to the compressor and a clock switch installed to operate the compressor during the night. In the area to be cooled are installed a water coil with fan and air filter. A thermostat is provided to start and stop the chilled water circulating pump independently of the operation of the compressor in the original system. Ask for catalog on this system.

DOC DOLECO Says—

25 years of specialization in plate refrigeration have made DOLE the leader, often imitated but never equalled.

DOLE REFRIGERATING COMPANY

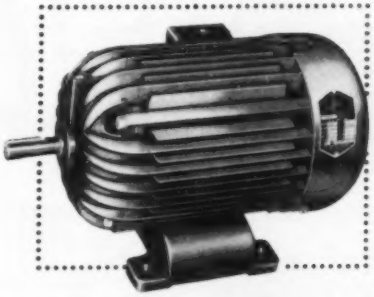
5918 N. PULASKI RD., CHICAGO 30, ILL.

103 Park Ave., New York 17

In Canada: Dole Refrigerating Products Limited, 44 Elgin Street, Brantford, Ontario.

New Hoover® Motors

totally enclosed



If you make a motor-driven product that must work where there's moisture, heavy dust, wood chips, or metal shavings—*these new, totally enclosed Hoover Motors are for you.*

And you are getting more for your money than with any comparable motor on the market.

There are both *self-cooled* and *fan-cooled* models—newly designed to keep trouble out and performance high. No openings to let moisture in. No blind passages to catch dust and dirt.

A working giant in a small package

Polyphase motors through 5 H. P. Capacitor start motors through 3 H. P. All built in NEMA frames. Extremely compact. More horsepower for each pound of motor—more motor for your money in every way.

Made and guaranteed by the makers of the famous Hoover Cleaners, who have been building precision motors since 1934. World-wide service facilities—always ready to protect your good name.

HOOVER

THE HOOVER COMPANY, Kingston-Conley Division
Dept. HPA-5 68 Brook Ave., North Plainfield, N. J.

Please send catalog showing and describing complete line of Hoover Motors.

Name _____

Address _____

City _____ **Zone** _____ **State** _____

Washington, D. C.-Philadelphia district, succeeding *WALT WOODROOF*, who is rejoining American Radiator & Standard Sanitary Corp. For the past two years, Mr. Quinn has been with the Lessner Co., Baker distributors in Philadelphia. Headquarters will remain at 1728 "L" St., N.W., Washington, D. C.

For *RAYTHEON MFG. CO.*, Waltham, Mass.—*HAROLD L. HERNDON*, district manager in charge of sales and service for the Cleveland district. Formerly service manager for the district, he is succeeded in that post by *ALBERT R. WOLFE*, who has assisted him for four years as a field engineer. The district, with offices at 902 Hanna Bldg., Cleveland, serves Michigan, Ohio, western New York, western Pennsylvania, West Virginia, and eastern Kentucky.

For *AMERICAN RADIATOR & STANDARD SANITARY CORP.*, Pittsburgh — *CHARLES J. SNODGRASS*, manager, Baltimore sales office, which covers most of Maryland and parts of southern Deleware and northwestern Virginia. Formerly assistant manager of the office, Mr. Snodgrass succeeds the late *ROY N. DOWNS*.

For *THE READY-POWER CO.*, Detroit — *E. P. SCHUMAKER*, southwestern district manager, with headquarters in Atlanta.

For *MUELLER BRASS CO.*, Port Huron, Mich. — *THEODORE HOWARD*, manager, Los Angeles branch sales office. He has been with the Refrigeration and Power Specialty Co., San Francisco. Assisting him will be *GRANT HUNTER*.

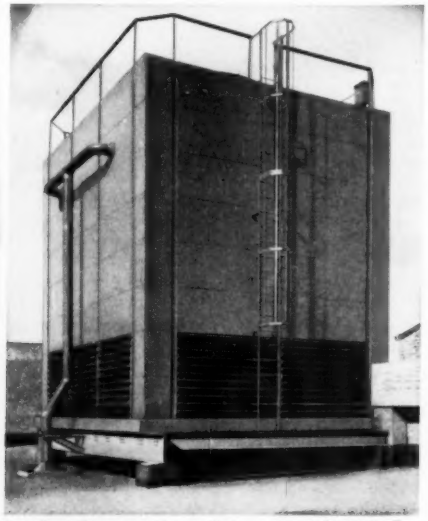
For *FRESH'ND-AIRE CO.*, Chicago—*W. K. SIMPSON CO.*, Memphis, representative for the complete line of air treatment equipment in Arkansas and western Tennessee.

For *PITTSBURGH CORNING CORP.*, Pittsburgh — *C. P. BARRETT*, eastern manager, industrial insulation sales, with headquarters at 30 Rockefeller Plaza, New York.

For *FIELD CONTROL DIV.*, Mendota, Ill. — *SALES ENGINEERS*, headed by *BRUCE McLOUTH*, 3517 Hennepin Ave., S., Minneapolis, to represent the complete line in North Dakota, Minnesota and part of Wisconsin.

For *WESTERN ENGINEERING & MFG. CO.*, Los Angeles — two New England stocking jobbers to handle roof ventilators: *LAWRENCE SUPPLY CO.*, Lawrence, Mass., and *ROBERTS DISTRIBUTORS*, Manchester, N.H.

For *GRAHAM REFRIGERATION PRODUCTS CO., INC.*, Springfield, Mass. — a new associate, *FRED W. SMITH*, former president, Baker Refrigeration Corp. The Graham Co. is the New England agency handling equipment for *KRAMER TRENTON CO., ACME INDUSTRIES, INC., EBCO MFG. CO.*, and *BREWER TITCHENER CORP. RAY GRAHAM* manages the company's headquarters at 1694 Main St., Springfield, and Mr. Smith,



Binks Type K tower at a large pharmaceutical plant in the East.

Mechanical Draft Cooling Towers

A complete line, each unit properly engineered for maximum cooling efficiency

Binks Mechanical Draft Cooling Towers are manufactured in several standardized models in capacities from 3 to 3000 GPM over the tower. You can have exactly the tower you need without the expense of a custom-built unit.

These towers are design-engineered to give you better performance under local conditions. An experience of more than 30 years in scientific water cooling is your assurance that Binks towers have the correct air-to-water ratio and fluid break-up for maximum heat dissipation.

Send for these bulletins
describing the complete line of mechanical draft cooling towers. No obligation, of course.

Bulletin 39—Type K (capacity ranges, 1000 to 3000 GPM)
Bulletin 36—Type 2K-S (150 to 660 GPM)
Bulletin 34—Type 2-D (150 to 300 GPM)
Bulletin 47-A—Type B (9 to 180 GPM)
Bulletin 33—Type 2-D (3 to 90 GPM)

Write to: Binks Manufacturing Company, 3118-38 W. Carroll, Chicago 14, Illinois

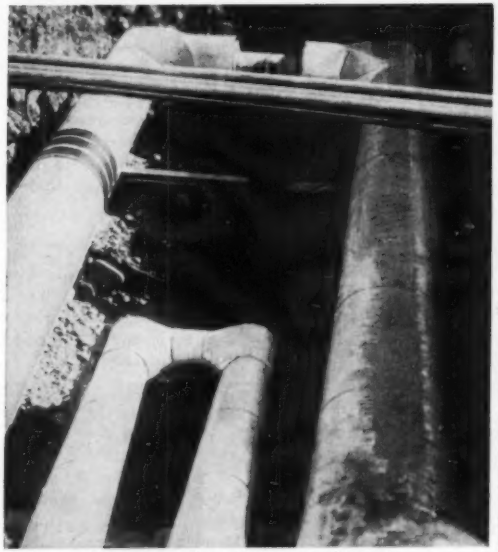
Binks

EVERYTHING FOR WATER COOLING · NATURAL AND MECHANICAL DRAFT COOLING TOWERS · INDUSTRIAL SPRAY NOZZLES

REPRESENTATIVES IN ALL PRINCIPAL CITIES · SEE YOUR CLASSIFIED DIRECTORY

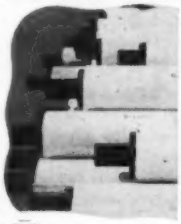
D.I.P.
REG. U. S. PAT. OFF.

Pre-Sealed Protection Built-In at Factory



- and Low Cost Installation Saves Time, Trouble and Work

Wherever you have a problem of conveyance of hot-water, steam or refrigerants, you can specify DURANT INSULATED PIPE with complete confidence in securing long range economy.



The combination of the best quality moulded insulation completely protected by non-porous asphalt merits the preference of architects, engineers, and contractors who have investigated the scientifically engineered construction methods employed in the fabrication of D. I. P.

Economy starts with installation. D. I. P. requires no tile, masonry, or sub-drains. Field joint work is simple, yet corrosion and electrolysis are eliminated. Low maintenance costs result in further economy over long years of dependable service.

Complete detailed information and engineering data on standard piping and special fittings will be furnished on request. Our representatives in principal cities are at your service.

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REG. U. S. PAT. OFF.

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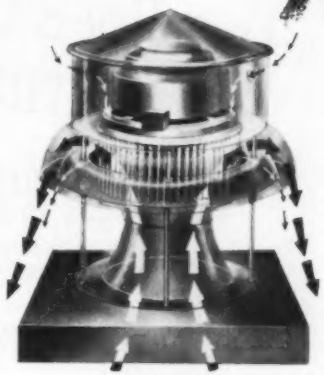
DURANT INTERNATIONAL CORPN.
WILLIAMSTOWN
NEW JERSEY

How to Tell Quality in Power

Ventilators



Pat. 2188741 2526290

1. Rugged Construction
2. Certified Ratings
3. Scroll Effect
4. Safe Moisture and Fume Removal

Before you buy any power ventilating equipment — compare the Gallaher Air-Van.®

Pound for pound Air-Vans have the heaviest construction of any comparable unit. Air-Vans are shipped with or without bases completely assembled, ready to install.

Gallaher performance rating are the result of independent laboratory tests. They are not interpolations which research has shown can be grossly inaccurate.

Air-Vans are designed with *scroll effect* built-in. Tests show that efficiency against even normal static pressures is impossible without this feature.

Motor out of air stream and a patented *positive air seal* off prevents fume passage into motor housing. Air-Vans have been specified WITHOUT special motors for ether and air concentrations.

Capacities 150-11,000 CFM Static Pressures to 1¾"

THE GALLAHER CO.
4108 Dodge St.
Omaha, Nebraska

Please send me full catalog information about Gallaher Power Ventilators.

NAME _____

ADDRESS _____

CITY _____ STATE _____

The GALLAHER Company
Omaha, Nebr. Owatonna, Minn.

MEMO

When to specify a Hev-E-Oil Burner

AND CUT FUEL BILLS AS MUCH AS 20% TO 30%

In commercial or industrial installations where a burner is used to heat a building containing over 1500 sq. ft. of installed radiation . . . or when 45 tons of coal . . . or 6000 gallons of light fuel oil are used each year, fuel bills can be cut as much as 20 to 30 per cent with a Cleaver-Brooks Hev-E Oil Burner. Here's why:

The Hev-E Oil Burner is designed to save money two ways — it utilizes the heavy, low-cost, high heat No. 5 oil — it saves on the total amount of oil used. Scores of outstanding successful installations prove its economical, efficient, trouble free performance.

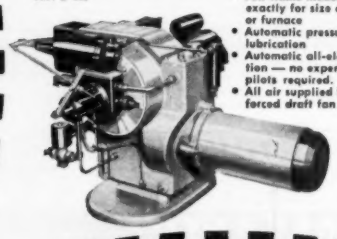
It will pay to investigate immediately — write today for Bulletin AD-102 and complete information — Hev-E Oil Burners are available in five sizes, 1 to 60 gallons per hour capacity, oil, gas, or combination oil and gas units.

CLEAVER-BROOKS COMPANY, HEV-E-OIL Burner Division
Dept. F 380E. Keefe Avenue, Milwaukee 12, Wis.

Cleaver-Brooks
HEV-E-OIL BURNER

"The Burner Designed to Save You Money"
For Commercial, Industrial, and Institutional Installations

- Burns low-cost, high-heat No. 5 oil
- Low fire starting
- Full-flame modulation — set exactly for size of boiler or furnace
- Automatic pressure lubrication
- Automatic all-electric ignition — no expensive gas-pilots required.
- All air supplied by large forced draft fan



heads the Boston office at 52 First St., Cambridge, and the Portland, Me., office at 402 Forest Ave.

For *L. J. MUELLER FURNACE CO.*, Milwaukee — *ERNEST C. BRINKMAN*, sales representative, St. Louis territory. He has spent two years as sales and engineering representative in Buffalo and St. Louis for a heating control manufacturer.

For *BEAVER PIPE TOOLS, INC.*, Warren, Ohio — *PAUL F. SACKETT*, Spartanburg, S. C., representative in North and South Carolina, eastern Tennessee, Georgia, Alabama and Florida. He has been manager of the plumbing and heating division, Montgomery and Crawford Co., for 11 years.

For *RADIATOR SPECIALTY CO.*, Charlotte, N.C. — four new representatives for the line of heating and plumbing specialties. They include: *SAMUEL SIMON*, Pittsburgh district; *RUSSELL W. KRESS*, Minneapolis district; *R. F. KRISINGER*, Des Moines district; and *WILLIAM C. PRUETT, JR.*, Charleston, W. Va., district.

For *GENE BROWN*, manufacturers' representative — a return to Texas, where he will devote full time to the operation of a sales agency. He will cover the state of Texas, and will supervise sales in the balance of the south and southwest through associates. Equipment handled will comprise heating, air conditioning and related lines. Those interested in representation may contact him at 5643 Dyer St., Dallas 6.

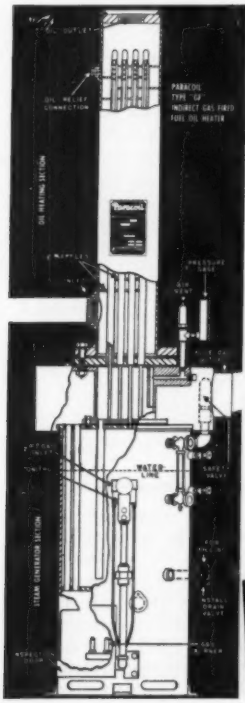
For *S. T. JOHNSON CO.*, Philadelphia — new distributor for oil burning equipment, *H. LIEBLICH & CO., INC.*, 36 W. 66th St., New York, covering Bergen, Passaic, Essex, Middlesex, Hudson and Union counties in northern New Jersey, and Nassau and Suffolk counties in Long Island. New dealer franchises are available in these territories. The company offers dealers "24 hour a day" service on new equipment and service parts.

For *CORNING GLASS WORKS*, Corning, N.Y. — new district sales office, Room 616, Kass Bldg., 711 14th St., N.W., Washington, D.C. *CHARLES L. DAY*, appointed manager, will act as liaison between the company and various agencies and departments of the federal government.

For *AIRTEMP DIV., CHRYSLER CORP.*, Dayton, Ohio —regional sales office for the territory comprising sections of Ohio, Pennsylvania, New York and West Virginia, moved from Cleveland to Pittsburgh. Three district representatives have been added to the Pittsburgh sales staff: *STANLEY R. KELLY, ARTHUR E. STRUCK* and *KEENE L. LeVAN*.

For *REMINGTON AIR CONDITIONING DIV., REMINGTON CORP.*, Auburn, N.Y. — *THE WESTINGHOUSE ELECTRIC SUPPLY CO.*, 905 E. Second St., Los Angeles, new distributor for room air conditioners. The franchise signed with Westinghouse covers the territorial area of Los Angeles, and branches in Phoenix, Salt Lake City, and Boise.

Refinite serves the World
WITH WATER CONDITIONING
EQUIPMENT & SERVICE
Refinite OMAHA, NEB.
WATER REFINING EQUIPMENT
Write for FREE Bulletins On How Refinite
Can Serve You. Address: Dept. HPA



A GREAT NEW DEVELOPMENT IN OIL PREHEATER DESIGN

Paracoil Keeps Pace With The Rapidly Changing Needs Of The Oil Burner Industry

The TYPE "GF" INDIRECT GAS FIRED FUEL OIL HEATER

A RADICALLY NEW APPROACH TO THE PROBLEM OF ADEQUATE OIL PREHEATING UNDER ALL OPERATING CONDITIONS!

The Type "GF" Oil Heater is an integrated self-contained steam vapor generating exchanger using gas as its primary heat source.

However, the gas flame does not come in contact with the tubes containing the fuel oil. Instead, vapor from the lower steam generating section does the actual oil heating!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

A COMPLETE SOLUTION TO THE OIL-IN-BOILER PROBLEM!

As the Type "GF" Heater is in no way connected to the steam or water space of any boiler it may be serving, there can be no possible contamination of the boiler heating surfaces in the event of an oil leak in the heater.

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated • Reduces oil consumption through improved fuel combustion.

THE PERFECT HEATER FOR:

- Low temperature forced hot water heating systems on No. 6 oil.
- Plants with starting difficulties after week end shutdowns.
- Supplementing inadequacies in present oil preheating systems.

Approved by Board of Standards and Appeals, City of New York—Cal. No. 362-515A

BULLETIN 60-L WRITE FOR YOUR COPY TODAY!

DAVIS ENGINEERING CORPORATION

30 ROCKEFELLER PLAZA · NEW YORK 20, NEW YORK • 1084 EAST GRAND STREET · ELIZABETH 4, NEW JERSEY

ENGINEERED
for tomorrow

. . . Badger EXPANSION JOINTS . . . assure long, trouble-free life . . . an engineering masterpiece

Leading utilities are erecting ultra-modern power plants which are both *designed* and *engineered* for tomorrow. The structures represent the very latest trends in functional design . . . and the steam distribution systems must be engineered to perform with maximum efficiency. As you would expect, Badger Corrugated Packless Expansion Joints, constructed to the famous Directed-Flexing Self-Equalizing design are first choice with these forward-looking utilities.

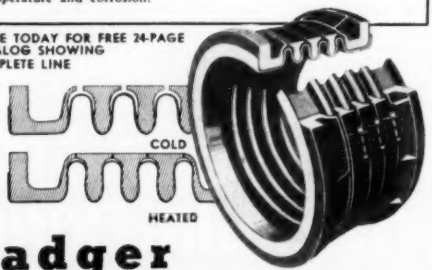
* * * * * *

What's the reason you find Badger Expansion Joints specified on *important* jobs? Because engineers have learned from years of experience to put their faith in the performance of Badger Joints . . . performance that's a result of construction features like these:

- Directed-Flexing Self-Equalizing rings . . . progressively control the movement of the all-curve corrugations.
- Packless . . . pressure-tight single tube — requires no maintenance.
- Compact . . . approximately the size of flanged fitting.
- Special forming . . . no structure-weakening stresses.
- Controlled heat treating . . . assures long life.
- Wide range of traverse — pressure — temperature.

Fabricated from deoxidized copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion.

WRITE TODAY FOR FREE 24-PAGE CATALOG SHOWING COMPLETE LINE



Badger
MANUFACTURING COMPANY
230 BENT STREET, CAMBRIDGE, MASS.

NEW BOOKS & REPORTS

Energy Sources

For years the American Petroleum Institute had sought someone to undertake preparation of a paper on energy sources, for presentation at an annual meeting. Finally, because the subject was very close to him, and because the job needed doing, Eugene Ayres, technical assistant to the executive vice president of Gulf Research and Development Co., volunteered to do it. After the paper was presented to the API meeting on November 9, 1948, the demand for reprints required running off 6000 copies. Then it was decided to expand the paper into a book, *Energy Sources—The Wealth of the World*, in joint authorship with Charles A. Scarlott, editor of *Westinghouse Engineer*.

The book's twenty-one chapters and three appendixes review the known sources of energy on this earth: fossil fuels (coal, oil, natural gas, oil shale, and tar), nuclear energy, solar radiation (including vegetation and peat), and wind and tide, revealing the probable potential of each. Present methods of utilization and possible avenues of improvement thereon receive thorough analysis. Considerable discussion is presented on the conversion of one fuel into another, such as production of synthetic liquid fuels from coal.

The book contains an invaluable compilation of data pertaining to fuels and energy. In particular, the final chapter, called *Energy Balance Sheet*, summarizes fuel production and ultimate consumers, including the various transformations of form along the way. The first two appendixes continue the data summary, and the third presents an excellent bibliography.

The authors have succeeded in writing a readable book on a technical subject, portraying the fuel drama almost as a novel unfolds its plot. And if this book has no plot, it certainly has a mission—to focus attention upon the lightning speed at which the world's energy store is being consumed, and to point out the inevitable recourse: to capture solar energy. Within a hundred years, say the authors, the world will depend for its energy upon four principal methods for converting solar energy: land vegetation (including industrial photosynthesis), waterfalls (streams are replenished because solar radiation evaporates ocean water), solar collectors for power, and solar collectors for space heating.

This 344 page book is available from the publisher, McGraw-Hill Book Co., 330 W. 42nd St., N. Y., at $5.00 a copy.

—Kalman Steiner

Use of Compressed Air in Industry and Mining

The wide range of applications of compressed air, and the diversity of tools and appliances operated by this power, are stressed in *Compressed Air in Mining and Industry*, compiled and edited by Sydney H. North, late editor, *Compressed Air Engineering*. It is designed to assist present and prospective users in determining what plant and equipment would be most suitable for any particular application. Special chapters on the basic features of compressed air installations have been contributed or

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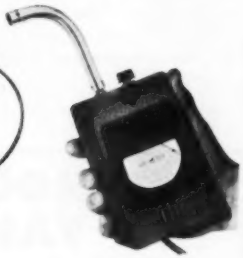
Hastings Model H Air Meter. Compact unit for field and laboratory use. Velocity Ranges: 10-750 fpm; 750-5500 fpm.



Hastings Model G Air-Meter. Small hand type instrument. Velocity range: 0-6000 fpm; Weight: 26 ounces.

Hastings Model B Air Meter for measurements of greatest precision. Velocity ranges: 0-400 fpm; 400 to 6,000 fpm. Meter type continuous calibration check. Knife edge, parallax free indicator.

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supervised by compressed air engineers. The other sections, dealing with applications in mining and industry, are based on various sources. Chapters discuss air compressor types in relation to requirements; compressed air in mines and quarries, in industry, and in constructional and public works; elimination of moisture, oil, dust and heat; pneumatic conveying of materials other than coal; portable compressors; pneumatic tools and appliances; lubrication, etc.

This 170 page book, published in London, is available from the distributor, Pitman Publishing Corp., 2 West 45th St., New York 19, at $4.00 a copy.

Air Conditioning, Refrigeration in Marine Service

Design, construction, operation and maintenance procedures on all types and systems of air conditioning, conditioned air, and refrigeration equipment now in marine service are treated in *Marine Air Conditioning and Refrigeration*, by Earl S. Shulters, construction representative, U. S. Maritime Administration. The book has been prepared as an enlargement of one first published in 1941, which covered refrigeration as applied to ships' stores, cargo compartments and living accommodations. The new handbook takes into consideration the rapid growth in demand for complete air conditioning of general cargo holds by mechanical and chemical means.

Part 1 includes an introduction to air conditioning and refrigeration, information on living accommodations, and general cargo hold conditioning, "Cargocaire" silica gel plants, and "Kathabar" plants. Part 2 covers theory of refrigeration; ship's service stores and general cargo refrigeration; "Freon 12," "Freon 11," ammonia, and CO_2 plants; and insulation and fan laws.

Chapters covering individual plants begin with a general description, and treat refrigeration machinery, flow of refrigerant through plant, handling of refrigerant, testing, charging the system, etc.

This 384 page book may be obtained from the publisher, Cornell Maritime Press, 241 W. 23rd St., New York 11, at $6.00 a copy.

Developments in Various Fields of Engineering

The Engineering Index, 1928-1949, which has just been reprinted, records developments in various fields of engineering and includes articles from engineering and industrial publications, transactions of engineering and allied societies, miscellaneous reports, and reviews of scientific and technical books. The annotated reference items provide a digest of information on technical, scientific and economic problems assembled during the period covered. Articles in the international engineering literature of these years have been abstracted and classified.

These volumes are no longer available in the original edition, and were reprinted with permission of the original publishers, by Johnson Reprint Corp., 125 E. 23rd St., New York 10. The reprinted 1928-32 volumes are priced at $300.00 for a set, and $70.00 for single volumes. The 1933-49 volumes are $900.00 for the set, $60.00 per volume.

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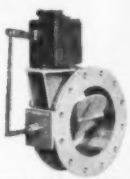

Standard cast iron flanged, butterfly valve with totally enclosed electric motor control.

Small threaded butterfly valve with air diaphragm control unit.

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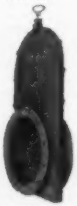

Standard slide valve, with pull handle control; sizes in lever and wheel control to 20".

Sheet metal switch gate with removable damper blades, controlled by an electric motor.

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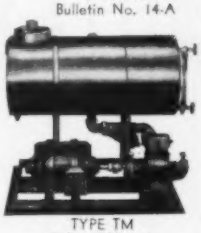

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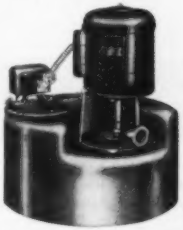

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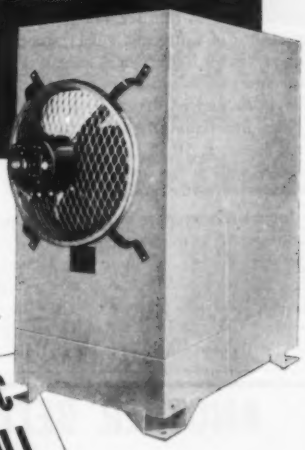

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The redistributing decks keep the water uniformly suspended, providing maximum contact between air and water.

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Casing and sump are heavy gauge steel, hot dipped galvanized after fabrication. Redistributing decks are metal and fireproof.

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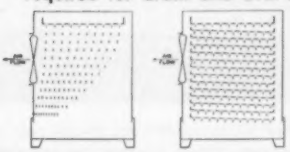
Unit is shipped assembled but can be knocked down to eliminate rigging costs. One fitting required for drain and over-flow.



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Survey of Heat Pump Engineering

In the past 20 years, interest has grown in utilization of the heat pump for heating and cooling buildings. Pumps ranging in capacity from 3 to 550 tons of refrigeration and using a variety of heat sources and sinks (atmospheric air, water, and the earth) have been installed. In the commercial field, the heat pump principle has proved satisfactory wherever suitable heat sources and heat sinks were available.

E. B. Penrod, in his reprinted article, *Progress in Heat Pump Engineering*, gives a brief account of the development of the heat pump, and then enumerates some of the physical problems that must be solved before the domestic heat pump can be made to operate as satisfactorily as the household refrigerator. He discusses the adaptability to domestic use of the Brayton air-to-air heat pump, and the suitability of water-to-air heat pumps and earth-to-air heat pumps. The Peltier heat pump, which may be made to heat and cool two different streams of water concurrently, also is treated in this regard.

This five page article is reprinted from *Physics Today*, Vol. 5, No. 2, 10-15, February, 1952.

Exhaust Hood Design

Increased emphasis on industrial health hazards in plants where harmful dusts, vapors, gases or fumes are generated has resulted in a demand for accurate design of exhaust systems, of which the hood is a critical part. *Exhaust Hoods*, by J. M. Dalla Valle, professor of chemical engineering, Georgia Institute of Technology, treats both fundamental theory (including latest thinking on the "dilution concept") and practical applications of theory to the design of hoods for all types of industrial installations. Basic material has been expanded in this second edition, and coordinated with data by other investigators, covering all phases of hood, booth, and slot design. The primary source of data is the author's own experimental investigations on the flow of air around and into the openings in exhaust ventilating systems.

Theory chapters cover flow of gases, velocity characteristics of canopy hoods, and criteria for determining hood effectiveness. Five chapters cover hood design for various types of applications. Other chapters cover booth-like structures, grille openings, entrance losses, etc. Sample problems and solutions are given in a special chapter.

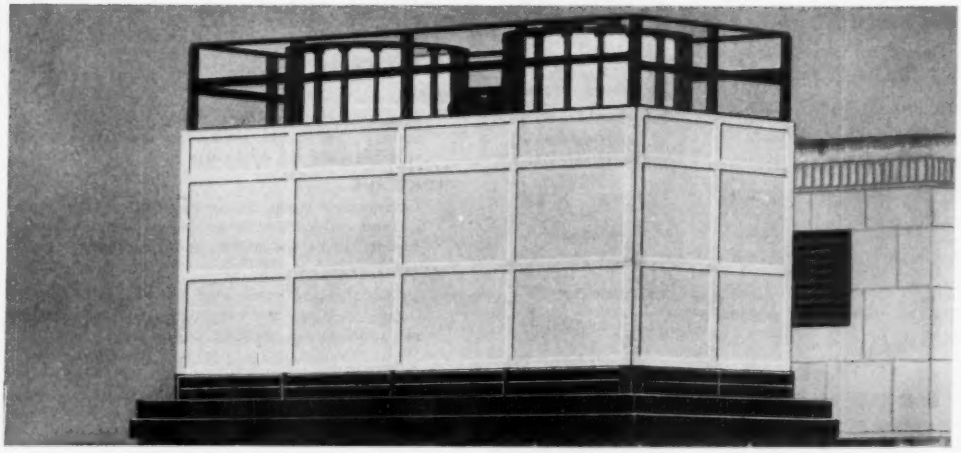
This 141 page book is available from the publisher, The Industrial Press, 148 Lafayette St., New York 13, at $3.50 a copy.

Bibliography of Literature on Odors

Odors and the Sense of Smell is a listing of works written on the science of osmics from 200 B. C. to 1947 A. D. It covers odor control, types of odors, the anatomy and physiology of the olfactory systems of animal and insect species, the pathology of odor perception, and other branches of the science of osmics, containing over 4000 references. Original articles appeared in 16 languages besides English, but all foreign titles have been translated into English.

This 294 page book is available from the publisher, and compiler, Airkem, Inc., 241 East 44th St., New York 17, at $15.00 a copy.

ANOTHER BETTER BUILT UNITED COOLING TOWER



Recently installed for air conditioning service atop a big Texas town city hall. Many similar installations throughout the country. Others in power and petroleum industries. Also 3 to 30 ton "package" type refrigeration units. Write for Bulletin No. 50. Get United plans and prices before you buy.

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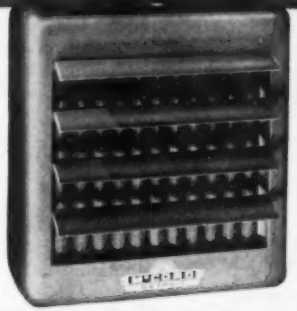

Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

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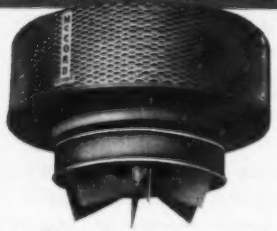

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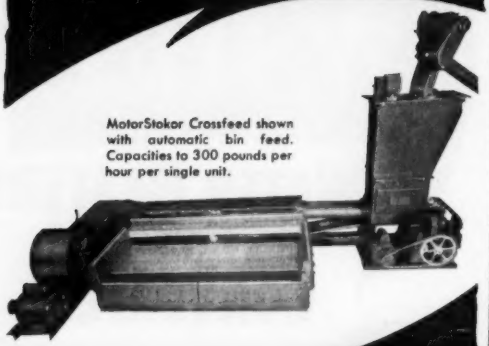

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Look at these outstanding features:

1. *No* moving parts in high temperature zone.
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Effect of High Temperature on Steels

A new report, published by the American Society for Testing Materials, should be of special interest to those establishing stress values and code requirements; to the designer of equipment, particularly where elevated temperatures are involved; to the metallurgist supervising production of steels; and to the technical people concerned with operating problems. This report, *The Elevated-Temperature Properties of Stainless Steels*, is essentially a graphical summary of elevated-temperature data for the commercially produced stainless steels. Included are summary curves for tensile strength, 0.2 percent offset yield strength, percent elongation, percent reduction of area, stresses for rupture in 100, 1000, 10,000 and 100,000 hr, and stress for creep rates 0.0001 and 0.00001 percent per hr. An appendix contains the primary data from which the curves were drawn.

The report, prepared by Ward F. Simmons and Howard C. Cross, of Battelle Memorial Institute, was issued under the auspices of the ASTM-ASME joint committee on effect of temperature on the properties of metals. The collection of data resulted from the close cooperation of many leading organizations concerned with production of stainless steel alloys, their fabrication into valves, flanges, fittings, etc., and of the users.

The 120 page report (STP No. 124) can be obtained from the ASTM, 1916 Race St., Philadelphia 3, at $4.00 a copy.

Control of Radioactive Contamination in Laboratories

Contamination of the person or of laboratory areas and equipment is a problem of fundamental importance to everyone working with radioactive isotopes.

Both aspects of the problem are discussed in *Control and Removal of Radioactive Contamination in Laboratories*, a National Bureau of Standards handbook. Detailed information is given of laboratory procedures designed to minimize the possibility of any accident, and to minimize the effects if such accidents occur. Wherever practical, recommendations are presented separately for different groups of isotopes. The booklet has been prepared as part of the program of the National Committee on Radiation Protection, for establishing safety procedures.

This 24 page handbook (No. 48, iv) is available from the Government Printing Office, Washington 25, D. C., at 15 cents a copy.

OTHER BOOKS AND REPORTS RECEIVED

NORTH AMERICAN COMBUSTION HANDBOOK is intended as a basic reference and text on the art and science of industrial heating with liquid and gaseous fuels. It contains a basic explanation of the theory of combustion; outlines for combustion, heat transfer and fluid flow calculations; charts and data to simplify calculations; and a discussion of combustion equipment, its selection and operation. It includes a glossary of terms used in the combustion industry.

This 322 page book is available from the publisher, The North American Mfg. Co., 4455 E. 71st St., Cleveland 5, at $2.00 a copy plus postage. It will be reviewed fully in a later issue.

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WITH SLIDING DAMPER CONTROL

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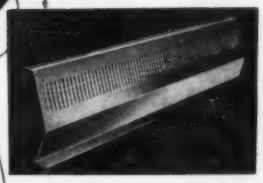

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- Comes in four foot sections.
- Simplifies balancing of heating systems.
- Fabricated of 20 gauge steel.
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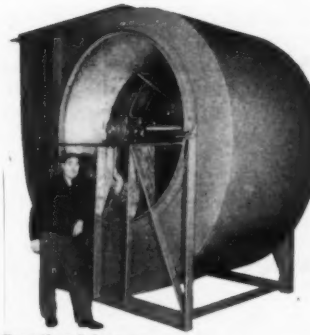

Centrifugal fans up to 240,000 CFM. Both forward curve and backward blade.

GENERAL BLOWER fans and blowers are recognized by engineers and contractors as a well-engineered and ruggedly constructed line. For conventional ventilating requirements . . . for high-temperature air service . . . for corrosive air handling or other unusual problems requiring special alloys or rubber coatings . . . whatever your requirements, GENERAL BLOWER can fill them.

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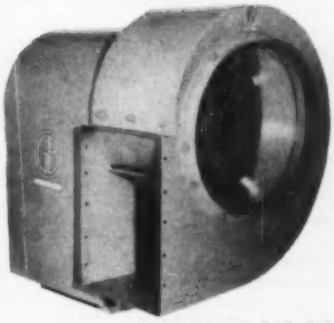

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MEETINGS & CONVENTIONS

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17 — Spring conference, the natural gas department, May 12 and 13, Biltmore Hotel, Los Angeles. A forum on pipe line safety will feature a discussion of the new ASA code for pressure piping. Underground storage of natural gas also will be among topics discussed.

Production and chemical conference, sponsored by the operating section, May 26 to 28, Hotel New Yorker, New York. Some subjects covered at different sessions are: natural gas pipe line deposits, air pollution, plant waste disposal, control of nuisance odors at odorization stations, and filters and dust problems.

The association's 34th annual convention will be held October 27 to 30, Atlantic City, N.J. An exhibit by the Gas Appliance Manufacturers Association will be held concurrently.

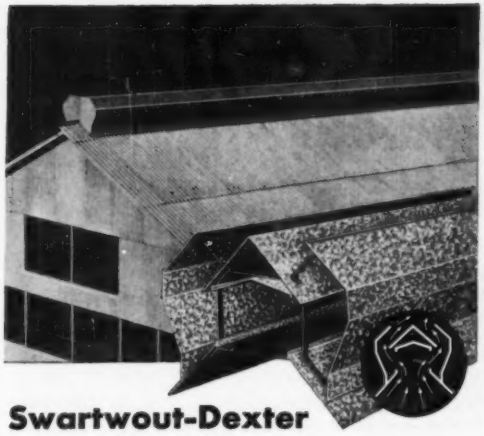
SHEET METAL CONTRACTOR'S NATIONAL ASSOCIATION, 170 Division St., Elgin, Ill.—Annual convention, May 12 to 14, Rochester, N.Y. For further information, contact publicity committee chairman, Irving G. Spalty, 546 Jefferson Ave., Rochester 11.

IBR SCHOOL OF MODERN HEATING — May 13 to 15, Jacksonville, Fla.; May 19 to 21, Atlanta; May 26 to 28, Pittsburgh; June 3 to 5, Rochester, N.Y. Sponsored by The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17. The school is a three day course providing instruction in the design and installation of hot water and steam heating systems. A complete list of meetings scheduled through June is available from the institute.

NATIONAL ASSOCIATION OF BUILDING OWNERS AND MANAGERS, 134 S. LaSalle St., Chicago 3 — 45th annual convention, May 18 to 22, Edgewater Beach Hotel, Chicago. Operating problems will be treated on May 21, one of the papers being *Cutting Heating Costs*, by Rex Hieronymus.

INTERNATIONAL CHURCHMAN'S EXPOSITION— May 19 to 24, Chicago International Amphitheatre. Exposition managers, M. W. Hinson and J. Vancil, 19 S. LaSalle St., Chicago 3. Purpose of exposition, to aid in the planning, construction, maintenance and more effective use of church property.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18 — 39th Spring meeting, June 1 to 4, Biltmore Hotel, Atlanta. Papers being considered for the technical sessions include some on refrigerant piping, electrical analogy of heat transfer, and lubrication. Informal conferences will run concurrently with technical sessions. In the all-year-around air conditioner conference, gas, electric and combination gas-electric air conditioners (and present and future markets) will be discussed, as will application of packaged conditioners to existing forced warm air residential heating systems.



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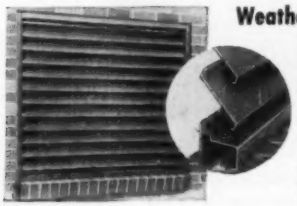

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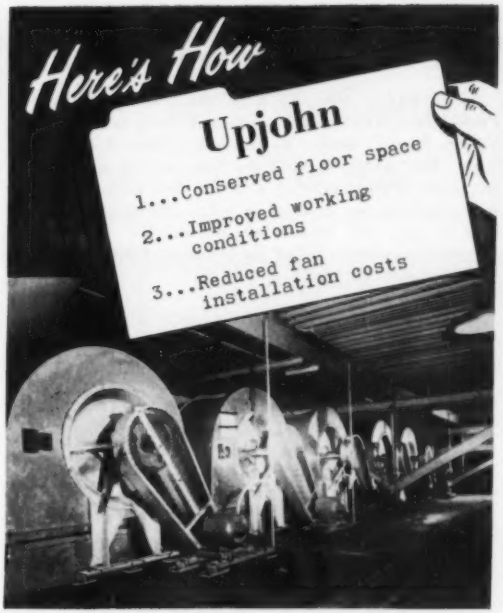

Five of the Clarage Heavy Duty Fans in the air conditioning systems of The Upjohn Company's new plant in Kalamazoo. Korfund Twin Rail Fan and Motor bases were used to prevent vibration and noise transmission into the supporting steel deck and the duct work.

. . . by installing over 200 fans and motors on Duplex bases

Upjohn has long been known for extreme care in the production of fine pharmaceuticals. Therefore, in building their new plant, quiet, spotless working conditions were a prime consideration. This called for 120 complete air conditioning systems with 324 Clarage Heavy Duty fans.

To conserve floor space, The Austin Company, Engineers and Builders planned the installation on suspended platforms and structural steel members under the roof.

Korfund Twin Rail Bases were specified so that no vibration or noise could reach the working areas through the steel decks or through the ducts, and to simplify the installation.

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The 38th annual meeting will be held November 30 to December 3, Hotel Commodore, New York.

SYMPOSIUM ON INSTRUMENTATION FOR THE PROCESS INDUSTRIES — June 2 to 4 (new dates), College Station, Texas. Sponsored by Texas A & M College. The revised dates have been set to permit full continuity without conflict with the Fall meeting of the Instrument Society of America. The course is conducted as a seminar, with lectures and discussions. For further information write Prof. P.G. Murdoch, Chemical Engineering Dept.

NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6—43rd annual meeting, June 3 to 6, Skytop Club, Skytop, Pa.

HEATING, PIPING & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, Suite 1401, Rockefeller Center, 1250 Avenue of the Americas, New York 20 — 63rd annual convention, June 10 to 13, Hotel Statler, Boston.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13—Semi-annual meeting, June 16 to 18, The Essex and Sussex, Spring Lake, N.J. For details see page 130.

STOKER MANUFACTURERS' ASSOCIATION, 307 N. Michigan Ave., Chicago 1—1952 annual meeting, June 23 and 24, South Shore Inn, Lake Wawasee, near Syracuse, Ind. There will be committee meetings, June 22.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—50th anniversary meeting, June 23 to 27, Hotels Statler and New Yorker, New York.

INSTRUMENT SOCIETY OF AMERICA, 1319 Allegheny Ave., Pittsburgh 33 — Seventh national instrument conference and exhibit, September 8 to 12, Cleveland.

SEVENTH NATIONAL CHEMICAL EXPOSITION—September 9 to 13, Coliseum, Chicago. Sponsored by the Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1.

AMERICAN INSTITUTE OF WHOLESALE PLUMBING AND HEATING SUPPLY ASSOCIATIONS, INC.—First national convention, October 19 to 22, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. For further information write G. T. Underwood, executive secretary, Room 402, Albee Bldg., 15th and G Sts., Washington, D.C.

11th INTERNATIONAL HEATING & VENTILATING EXPOSITION — THE AIR CONDITIONING EXPOSITION — January 26 to 30, 1953, International Amphitheatre, Chicago. Held under the auspices of The American Society of Heating and Ventilating Engineers. Address inquiries to the exposition management, International Exposition Co., Inc., Grand Central Palace, New York 17.

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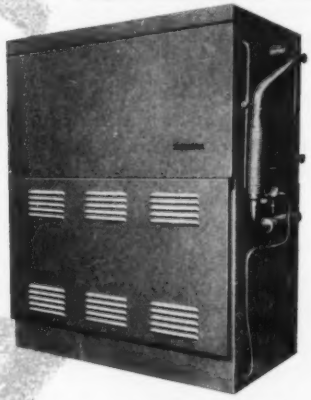

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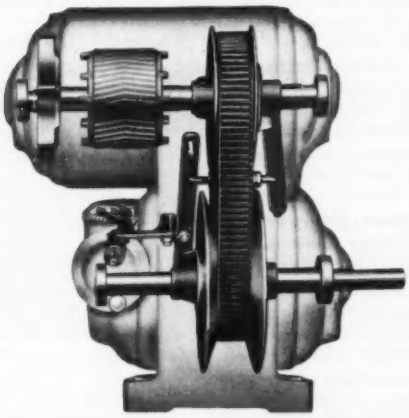

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WRITE FOR BULLETIN NO. FQ-112

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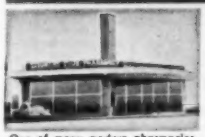
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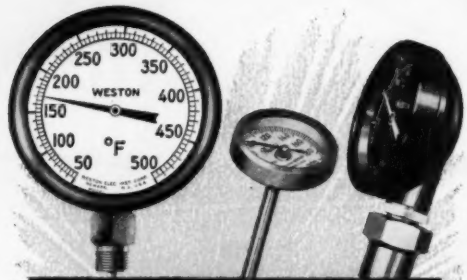

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Standard Angle Form	6"	−100F	+1000F	2½"	72"	1
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Air Conditioning Smoke Alarm

HPAC 101—Bulletin AC-2 describes an "electric eye" unit which guards against smoke circulated by air conditioning systems — Ess Instrument Co., 96 Washington Ave., Bergenfield, N. J. Smoke may enter system from an outside source, be recirculated from fire in other parts of the system or arise from spontaneous combustion in filters. The unit will give an alarm or shut down circulating fans.

Air Diffuser Selection

HPAC 102—Manual 40 (1952) is a 64 page catalog containing technical data designed to simplify selection of air diffusers for air conditioning systems — Anemostat Corp. of America, 10 E. 39th St., New York. This revised edition contains a new section on units for high pressure, high velocity systems. Illustrated with photographs, tables of performance data, and case examples, it shows how proper locations and the correct number of required units are determined. Covered are various types of diffusers, accessories, installation instructions, the company's air meter, and prices and weights.

Air Traps, Steam Humidifiers and Other Equipment

HPAC 103—Five revised bulletins covering air traps and other equipment replace preceding editions — Armstrong Machine Works, 874 Maple St., Three Rivers, Mich. Bulletin 2062 covers air relief traps for venting air from any liquid under pressure. Bulletin 2021 gives selection and installation information on air traps for automatic drainage of water from compressed air intercoolers, aftercoolers, receivers, separators and drip points. Bulletin 1722 gives installation and maintenance suggestions (utilizing diagrams and tables) for traps. Bulletin 1773 covers steam humidifiers, giving installation and application information, specifications, etc., and Bulletin 2001 treats Y-Type strainers.

Automatic, Self-Cleaning Air Filters

HPAC 104—Bulletin and technical data book on automatic, self-cleaning air filters which operate on the viscous impingement principle, utilizing a filtering medium composed of die-formed metal strips, usually aluminum — Continental Air Filters, Inc., 2520 Helm St., Louisville, 1. The filter medium is described, and information is given on filter curtain, drive mechanism, filter housing, performance, selection of filters, capacities and dimensions, filter oil, draft gages, etc.

Automatic Water and Steam Valves

HPAC 105—Bulletin G-3 (eight pages) describes "Cushioned" automatic water and steam valves — Golden Ander-

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A drafting room in Utah . . . an ice cream bar in Mississippi . . . a specialty shop in New York . . . each has its particular human comfort problems. All are met with Frick Unit Air Conditioners . . . because they're designed to be adaptable . . . having extra cooling capacity . . . as well as provision for optional winter heating . . . plus record - breaking dependability. • They are applied to each job by experienced refrigerating engineers. You get this superior equipment and superior engineering service only when you install Frick Air Conditioners. Write, wire, phone or visit us: Branches and Distributors in all principal cities.

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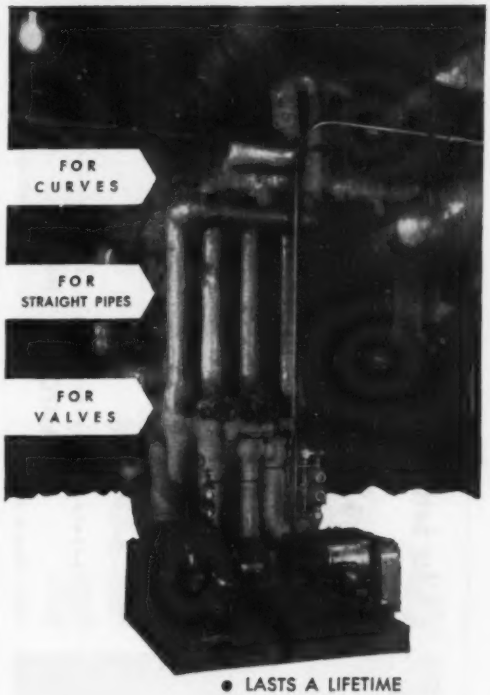

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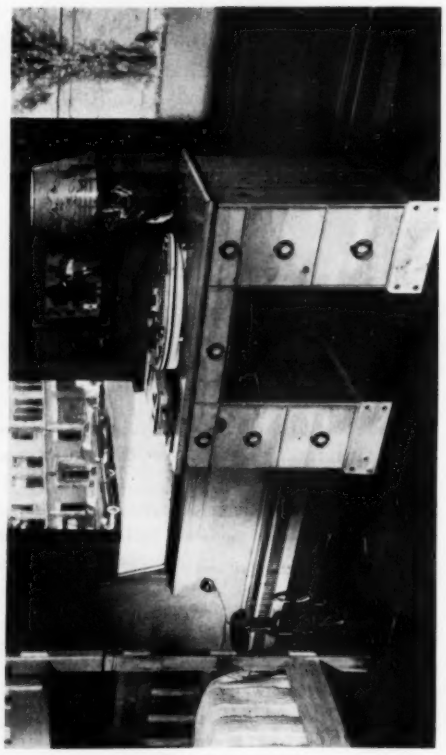

son Valve Specialty Co., 2104 Keenan Bldg., Pittsburgh 22. Featured are float, altitude, check, relief and non-return valves.

Bellows Template Kit

HPAC 106—Kit of bellows templates, including 20 popular bellows sizes, is intended to cut drafting and design time—Clifford Mfg. Co., Waltham, Mass. The selected template is placed under the tracing paper, the center line of the template matching that of the sketch or production drawing. Body and type of bellows ends may then be traced, and dimensions added as shown on the template. Templates show standard dimensions of the most common and readily available bellows, within close limits of true scale. The back of the enclosing envelope contains a table of sizes and characteristics of the company's bellows, with key numbers for ordering. Write for the kit direct to the manufacturer, on letterhead.

Boiler

HPAC 107—Folder describes and illustrates Type R "Square Heat" boilers for use with oil or gas burners or stokers, and in 12 sizes from 178,000 to 1,200,000 Btu per hr—Kewanee Boiler Corp., Franklin St. and "Q" Tracks, Kewanee, Ill. Versatility of the unit is emphasized, and typical applications are illustrated.

Brazing Manual

HPAC 108—Brazing manual (16 pages) contains information for the operator on brazing shapes, sheet, castings, tubing and assemblies of copper, brass, steel, aluminum and cast iron—All-State Welding Alloys Co., Inc., White Plains, N. Y.

Ceiling for Radiant Heating, Cooling, and Acoustical Control

HPAC 109—Bulletin A-102 describes a special ceiling which provides uniform radiant panel heating and cooling and acoustic control—Burgess-Manning Co., Architectural Products Div., 5970 Northwest Highway, Chicago 31. Special features are illustrated, components and performance are described, and installation and application photographs are included.

Conservation of Aluminum

HPAC 110—Booklet, *Conservation of Aluminum*, discusses efficient use of available supplies of the metal, as well as proper handling of scrap—The Aluminum Association, 420 Lexington Ave., New York 17.

Constant Voltage Transformers

HPAC 111—Booklet P-46-CV 142 (22 pages) provides a cross reference to constant voltage transformers—Sola Electric Co., 4633 W. 16th St., Chicago 50. It covers the standard regulators and four new types which have been added to the line since the last complete catalog was issued. Some of the topics covered are: checking with voltmeters, load regulation, effect of frequency, etc. There are charts indicating recordings of average, best and extreme conditions of line voltage. Performance data, specifications, dimensional diagrams, etc., are included.

Dust Collectors Used in Manufacture of Roofing

HPAC 112—Bulletin 322 discusses the use of "Dustube" cloth type dust collectors in eliminating dust conditions cre-

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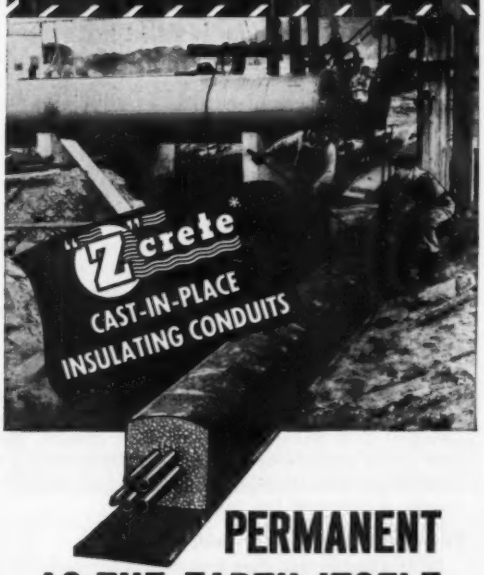

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Fans and Blowers

HPAC 113—Complete catalog, price sheet and engineering bulletin describes 30 fan types in over 300 sizes—Chelsea Fan & Blower Co., Inc., 639 South Ave., Plainfield, N. J. Included are complete specifications, dimensions, installation diagrams and product photographs, as well as information on the proper selection of fans for industrial, commercial and residential requirements.

Fin Tube Type Convectors

HPAC 114—Catalog 587 (four pages) gives information on design, ratings, installation and performance of "Fintube" convectors for use in schools, hospitals, factories, public buildings, apartments or business offices—The National Radiator Co., Johnstown, Pa. The convectors can be utilized in hot water or steam heating systems at low or high pressure. Covers and enclosures for the convectors are described and illustrated.

Fuel Oils and Additives

HPAC 115—Technical folder treats the problems involved in the burning of fuel oils and the application of additives—E. F. Drew & Co., Inc., 15 E. 26th St., New York 10. It presents data based on research which was aimed at the elimination of sludge, soot and slag in the burning of industrial fuel oil.

Fuel Saving for Public Housing Units

HPAC 116—Booklet, *Save Fuel Save Dollars*, offers nine ways to reduce heat waste and achieve up to 25 percent savings in fuel costs in public housing projects—Minneapolis-Honeywell Regulator Co., Merchandising Div., 2753 Fourth Ave. South, Minneapolis. Suggestions cover a variety of methods, ranging from proper combustion to zoning for wind and sun and thermostatic control in each apartment.

Gear Motors

HPAC 117—Bulletin GEA-5678 (eight pages) covers fractional horsepower gear motors, listing 61 standard models—General Electric Co., Schenectady 5, N. Y. It describes applications, and outlines a method of determining correct horsepower requirements with the use of an ordinary pipe wrench and fish scale.

Index to Literature and Motion Pictures on Aluminum

HPAC 118—Index lists technical literature and motion pictures on aluminum, which are available to people in the metalworking industry—Reynolds Metals Co., Desk "A" 2500 S. Third St., Louisville. The literature is categorized under design, fabrication, application, products and general information. Seven 16 mm motion pictures are listed.

Measurement of Flow in Open Channels

HPAC 119—Instrumentation data sheet No. 10.3-4 treats measurement of flow in open channels—Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40,

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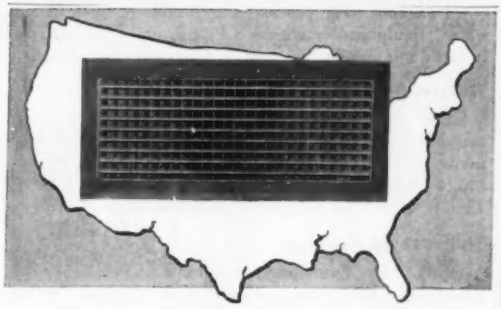

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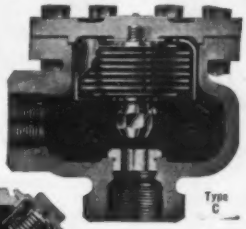

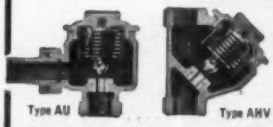

BULLETIN 152

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TRAPS · VALVES · FLOATS

TYPE F43A

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Manufacturers with thermal control problems similar to those encountered in water baths, industrial ovens, hot plate presses, coffee roasters and heating equipment should investigate the Type F43A dual switch thermostat. It is a precision-built temperature control available with a wide variety of thermal assemblies and switches for use between -150° F and +600° F. It can control two separate circuits simultaneously as required, for instance, in an air conditioning system where a fan control and compressor control are required.

Write for bulletin #3-4 which gives full specifications.

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Take a look at the new silhouette . . . . it's low slung and streamlined — better looking on any roof!
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WRITE TODAY FOR MORE INFORMATION ON MUCKLE VENTS.

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Wayne and Windrim Aves, Philadelphia 44. It describes the operation of the company's float actuated, evenly divided flow meters which are especially applicable where Parshall flumes and weirs are used to create a fluid head. Various system arrangements, principle of operation, specifications, etc., are covered.

Miniature Indicator

HPAC 120—Specification sheet 770 describes the operation of the "Tel-O-Set" miniature indicating pneumatic receiver that provides manual loading and remote index setting—Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. It includes illustrations of the approximately 5 x 5 in. instrument, and shows how it is used in a typical control system.

Motor Start Capacitors

HPAC 121—Catalog C-907 features new motor capacitor types in metal and plastic cases, new "speedy-change" terminals, smaller capacitor sizes and complete listings of replacement units for 125, 160, 220 and 320 volt as well as 110 volt services—Sprague Products Co., North Adams, Mass.

Non-Chemical Scale Elimination Water Treatment

HPAC 122—Folder describes "Hydrotron" water treatment process and equipment for eliminating scale in heat exchange equipment by changing water electro-physically, so that minerals crystallize out in the form of sludge or slurry—Heller Laboratories, 196 Morgan St., Jersey City 2, N. J. The sludge can be removed by the usual blowdown methods. The process is applicable to fresh or salt water. Equipment comprises a bronze pipe unit, installed in the water supply line, and an electrical control unit.

Nozzles for Roof Cooling Systems

HPAC 123—Bulletin 20A describes "Streamjet" nozzles for roof cooling systems in which it is important to use a minimum amount of water—Water Cooling Corp., 71 Nassau St., New York 38. Coverage is listed as approximately 1200 sq ft of roof per gpm of water at 20 lb pressure.

Nylon-Lined Bearings

HPAC 124—Four page bulletin treats the operating principles, design, and applications of "Nylined" nylon-lined bearings for rotation and reciprocation—Thomson Industries, Inc., Manhasset, N. Y.

Power Equipment Maintenance

HPAC 125—Booklet B-5477 outlines a preventive maintenance program for industry, designed to reduce shutdown time, with special emphasis on power equipment—Westinghouse Electric Corp., Box 2099, Pittsburgh 30. A suggested schedule of work and cleaning on power equipment is presented in chart form. Covered in the text are turbines, generators, controls, etc.

Protective Coating for Aluminum

HPAC 126—Folder describes "Alodine" coating for preventing corrosion of both painted and unpainted aluminum, which is applied by a brush or spray-on process—American Chemical Paint Co., Ambler, Pa. The application process is described and illustrated.

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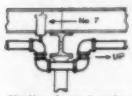
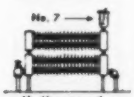


Venting trapped mains and circulating lines



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Type WDA (Hollow cone) **Type WDB (Solid cone)**

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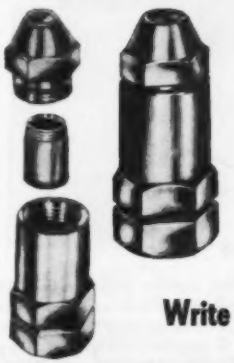

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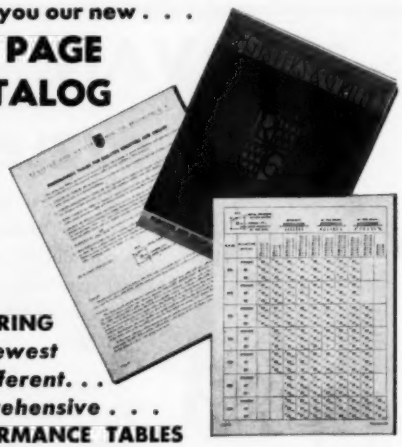

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HPAC 127—Four page bulletin describes a dozen different special coatings for plant maintenance (used in skidproofing, rust prevention, weatherproofing, etc.)—United Laboratories, Inc., 16801 Euclid Ave., Cleveland 12.

Pumps

HPAC 128—Complete pump catalog with sections covering engineering data and architects specifications, sewage ejectors, drainage pumps, water supply systems, circulating pumps, hot water circulating, condensation return pumps and condenser water pumps—Weil Pump Co., 1523 N. Fremont St., Chicago 22. Indexing is on the basis of purpose rather than style of pump. Many of the revised bulletins begin with recommended installations for the particular pump, permitting the engineer to determine whether or not the pump covered is the one he needs for a specific application. These bulletins also cover what a complete unit consists of, installation and application problems (determination of size of pump needed, physical dimensions, etc.), and the various types of controls available for each unit. There are complete performance and selection tables. Requests for the catalog should be sent direct to the manufacturer, on letterhead.

Registers and Grilles

HPAC 129—Register Book 52 illustrates and describes a complete line of registers and grilles for heating, air conditioning and ventilating—Auer Register Co., 6600 Clement Ave., Cleveland 5. It covers several newly developed models as well as changes and improvements in previous items. Copies will be sent to any qualified distributor, free of charge, on request to the manufacturer.

Remote Pressure Recorder

HPAC 130—Instrumentation data sheet 10.2-5 covers a remote pressure recorder comprising the "Frederick Flader Teledyne" unit, plus the "Electronik" recorder—Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. Applications, equipment requirements and operating principles are discussed, and specifications for the pressure transmitters are given.

Resistance Thermometers Used in Steam Generating Stations

HPAC 131—Instrumentation data sheet 9.1-12 discusses the use of resistance thermometers for obtaining temperature measurements in steam generating stations—Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. Details are given on the d-c Wheatstone bridge circuit, resistance thermometer bulb design and continuous balance type recorders.

Self-Contained Units for Purifying and Deodorizing Air

HPAC 132—Form No. 131-252 is a data sheet describing self-contained units which utilize activated, coconut-shell carbon, to purify and remove odors from air—Pur Air Div., American Solvent Recovery Corp., Columbus 3, Ohio. It describes, illustrates, and gives specifications for two models, one for spaces up to 4500 cu ft, the other for spaces up to 10,000 cu ft. Both models are fully assembled and ready to plug in.

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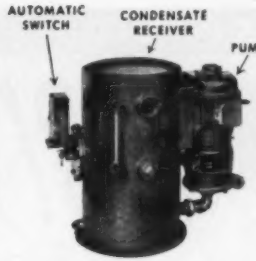

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HPAC 133—50 page full line catalog covering pipe markers, wire markers, masks and stencils, and other self-sticking industrial products—W. H. Brady Co., Dept. 217, 1630 E. Spring St., Chippewa Falls, Wis. Prices also are included.

Service Manual for Boiler Water Feeders, Low Water Fuel Cutoffs, etc.

HPAC 134—28 page service manual covers a line of boiler water feeders, low water fuel cutoffs, safety relief valves and related products—McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18. It has general servicing information, plus specific instructions for individual products. Cross section illustrations are used throughout to identify the replacement parts available. A product index is included for quick reference to the information and parts that apply.

Sheet Metal Production

HPAC 135—Catalog covers sheet metal designing and producing facilities, including ovens, heaters, air make-up units, spray booths and washers—Burdett Mfg. Co., 3433 W. Madison St., Chicago 24.

Small Line Type Purifiers

HPAC 136—Bulletin 500 (six pages) describes small line type "Hi-ef" purifiers used to clean up small pipelines carrying live or exhaust steam, vapors and air—V. D. Anderson Co., Purifier Div., 1935 W. 96th St., Cleveland 2. Diagrams of typical installations, specifications, and prices are given for the units, which range in size from ½ to 2 in.

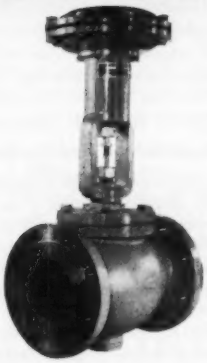
Small Pump Applications

HPAC 137—Reference chart lists various types of small pumps, the services for which each is built, performance characteristics, types of packing, styles of mounting and features distinguishing each model—Tuthill Pump Co., 939 E. 95th St., Chicago 19.

Tests of Effectiveness of Odor Neutralizer

HPAC 138—Report (10 pages) describes a series of tests conducted to determine the odor reduction effectiveness of "Renovair"—Boyle-Midway Inc., 22 E. 40th St., New York 16. A standardized odor was vaporized into the air stream and fed to a test room at a fixed rate until an odor level had been stabilized. Eight to 11 people, constituting a jury, were invited singly into the room, and each indicated his impression of the odor conditions on a rating sheet. Then, with the odor agent being fed in at the same fixed rate, controlled amounts of "Renovair" were added into the air conditioning duct by means of the company's "Gyrostatic Evaporator". Five different odors were used. As a result of these and additional tests, involving more than 100 individual observers' reactions, it was concluded that: (1) the product resulted in a decided reduction in odor level intensity; (2) there was no evidence of anesthesia or of narcosis of the olfactory organs; (3) odor level remaining after treatment with the product was pleasant and indicated essentially complete olfactory disappearance of the malodorous material; and (4) since the amount of replacement air was a very small fraction of the total air being moved through the system, the counteracting of odor could not be considered as due to dilution.

WARREN



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Time Switches

HPAC 139—Bulletin 5207-10M describes Series 700 time switches—Paragon Electric Co., Two Rivers, Wis. It includes illustrations of the seven day calendar dial switches, descriptions of their applications, diagrams depicting the internal wiring of the switches and a series of diagrams for their application to various heating systems. With these switches, heating, ventilating, or any electrically controlled operations can be turned on or off automatically at different hours each day, if desired.

Units For Air Conditioning And Product Cooling

HPAC 140—Catalog BE describes applications and gives specifications and selection data, etc., for "Ice-Cel" units for air conditioning and product cooling—Dole Refrigerating Co., 5910 North Pulaski Rd., Chicago 30. They can be used for peak loads of short duration, with large and small zones on one system, for air conditioning of older buildings, for use as boosters, etc., and in product cooling. The unit consists of a tank of water in which are immersed vacuum plates connected to a compressor, the tank being connected to a circulating water system. The operation of the compressor pulls down the temperature of the unit, which results in ice forming on the plates. When cooling effect is desired, a water circulating pump is started, and the melting ice produces chilled water, which circulates through finned coils to cool the air. Condensed catalog B, describing the unit, also is available.

Units for Heat Transfer

HPAC 141—Six page bulletin describes "Platecoil" heat transfer units which, the manufacturer states, require less steel because the heating solution flows in channels formed by joining the two embossed metal surface plates—Kold-Hold Mfg. Co., Lansing, Mich. This construction is intended to provide strength and rigidity, permitting use of the units in applications where conventional pipe coils are used, and also, where such pipe coils would not be adaptable. Typical applications include heating of bonderized tanks, parkerizing tanks, plating tanks, etc.

V Belt Drive Selection Guide

HPAC 142—Catalog 50-A is an engineering guide to multiple v belt drives—Fort Worth Steel & Machinery Co., P. O. Box 1038, Fort Worth. Simple formulas for standard quarter turn and v flat drives are augmented by tables of drives in all belt sections, which have been compiled for quick selection of drives of required ratio and speed. Also contained is engineering information on other types of v belt drives.

Variable-Area Flow Meters

HPAC 143—40 page handbook designed as an aid in the selection and sizing of variable-area flow meters—Fischer & Porter Co., Hatboro, Pa. It contains a complete description of meters, tubes and floats and their comparison with variable-head meters, as well as calibration prediction data.

Variable Transformer

HPAC 144—Bulletin P252 covers the new Type 10 "Powerstat" variable transformer for variable a-c voltage control problems involving 50, 100 and 150 watts—The Superior Electric Co., Bristol, Conn. Outline dimensions, ratings, and other descriptive material are included.

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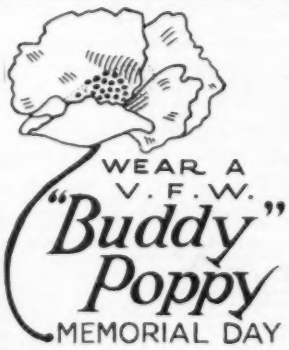

situations wanted

Mechanical Engineer, age 30, married, B S M E, 5 years experience in design and layout of heating, air conditioning, ventilating and plumbing. Desires position with engineer or contractor in Arizona, Colorado, New Mexico or Texas. Address Key 947A-Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

Mechanical Engineer, age 37, married, B S M E 16 years engineering experience. Last 7 years engineer and estimator for large mechanical contractor. Registered professional engineer. Prefer position with contractor or consulting firm. Will send resume on request. Address Key 950 A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

Sales executive will be available after June First. Qualifications, merchandising and product promotion, heavy experience in refrigeration air conditioning and heating; ability to handle, train and get along with people; extensive compressor experience; national following of wholesalers, distributors and manufacturers representatives; very aggressive, ability to assume heavy responsibilities. Financial remuneration must be in accordance to abilities. Address Key 953 A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

situations open

Midwest manufacturer of specialties for heating and air conditioning needs engineer to prepare application data and technical literature. Permanent position. Give complete details. Address Key 949 A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

Chief Mechanical Engineer. Must be experienced in handling design and production of all mechanical requirements of large commercial architect. Office Located in Pacific Northwest. Salary open. Address Key #951 A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

Representatives for line of heating and ventilating equipment wanted. Territories of Louisiana, Michigan, Ohio and Tennessee Open. Address Key #952 A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

lines wanted

Well established manufacturers agent with successful selling record desires additional lines on commission basis sold to industrials etc., for Indiana and adjoining territories, address Key #948 A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

Agent wishes additional Air Conditioning, heating and ventilating lines. Territories, Indiana, Eastern Illinois, Western Ohio and Northern Kentucky. Address Key 942A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

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The interior areas in the building are served by 51 central-type air conditioning systems, and 105 Johnson T-315 Submaster Room Thermostats control Johnson V-105 coil valves on the steam supply to booster heaters.

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